MAIN CURRENTS
IN MODERN THOUGHT

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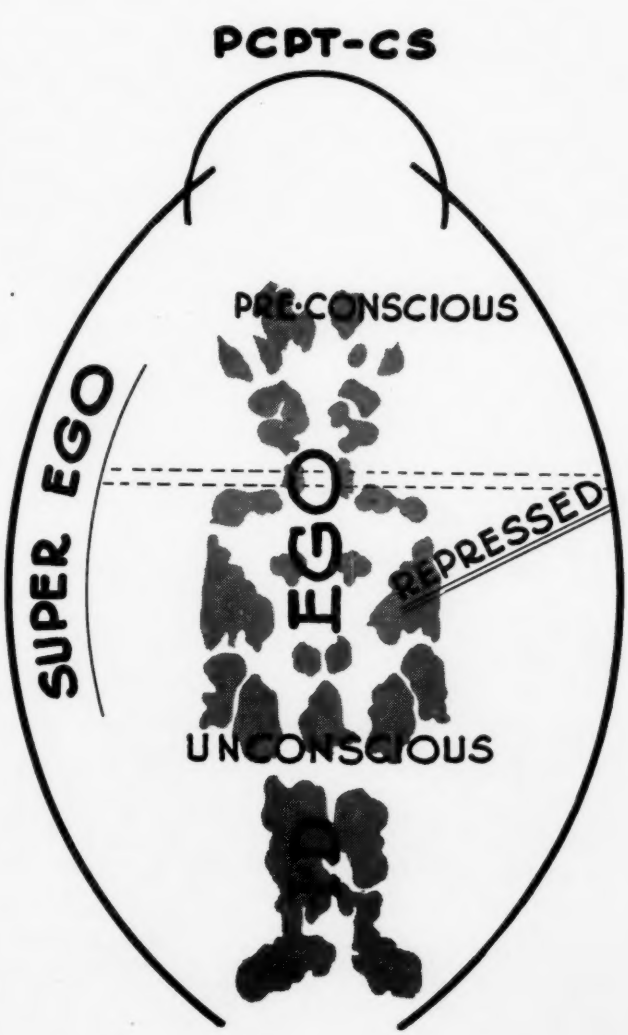

MODERN MAN IN SEARCH OF A SOUL

(SEE ACKNOWLEDGMENT, OVERLEAF)

MAIN CURRENTS IN MODERN THOUGHT

A co-operative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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"Ah, but a man's reach should exceed his grasp, or what's a heaven for?" —BROWNING

HUMANITY.....*Editorial Summary*

GRADATION, EVOLUTION, & REINCARNATION.....*Ananda K. Coomaraswamy*

VARIOUS VOICES.....*Brief Extracts*

Lunacy in Maple Trees
Warts Wished Away
Psychostomatics
Man A Conditioned Logos
Psychogenic Fever
Equilibria

A PSYCHO-PHYSIOLOGICAL STUDY.....*Thérèse Brosse*

CREATIVITY AS EDUCATION'S CORE.....*Oliver L. Reiser*

MAJOR BIOLOGICAL PRINCIPLES.....*W. Edgar Martin*

ACKNOWLEDGMENT: The drawing on the cover is based upon Sigmund Freud's representation of "the structural relations within the mental personality" of the Ego, the Id, and the Super-Ego, together with the domains of the pre-conscious, the repressed, and the unconscious. (Letters at the top signify perceptual conscious). We are indebted to W. W. Norton and Co., Inc., New York, publishers of *New Introductory Lectures on Psycho-Analysis,* (wherein Freud's "simple diagram" will be found on page 111) for permission to use this item. To it we have added an example of Gestalt closure, a startled and bewildered human form, in the shape of a Rorschach ink blot, the whole forming a montage of "modern man in search of a soul," as described by Jung in his popular book of that name.

MAIN CURRENTS IN MODERN THOUGHT is published quarterly to call attention to significant contributions to learning currently being made by leading workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. *Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can be and should be made the central core of curricular study in the educative process at all levels of development.* In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Contributors to MAIN CURRENTS enjoy full liberty of opinion and of expression in these pages. Copyright 1946, by F. L. Kunz, Editor, Port Chester, New York, to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. E. B. Sellon, Associate Editor. Entered as second class matter April 13th, 1946, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.

IMMENSE and fruitful labors have recently been expended to establish "basic, first-order variables of a science of individual differences" among men. With the appearance of *The Varieties of Temperament,* by Dr. W. H. Sheldon, and his collaborator, Dr. S. S. Stevens (Harper, 1942, from which we quoted above) a foundation is provided upon which to rest a true science of human taxonomy, obviously incomplete until the psyche has been classified along with the body. It is not easy to call to mind any study more important to the human race, which still, in terms of any general scientific agreement, has to fulfill the classical directive: Man, Know Thyself.

In the first of Dr. Sheldon's studies, *The Varieties of Human Physique* (Harper, 1940) three physical types of males were established by means of a specially devised measuring machine and scales of proportions. In any given instance the rating of the individual in each of these three scales determines his place as a somatype, displaying various features in various degrees of the basal varieties, which are readily recognized by the lay observer from exaggerated or extreme examples; (1) Broad in the hips, relatively narrow in the shoulders, burdened with adipose tissue; (2) shoulders broad, hips relatively narrow, well framed, strongly muscled; (3) slender, small-boned, often flat-chested. As these structural specialties can be traced back to the three germ layers of the human ovum, the types have been given the names endomorphy, mesomorphy, and ectomorphy. A truly remarkable variety of further features has been correlated into this simple classification, and the system stands as a solid construction.

So long as the data is limited to physical form, any classification of human types must of necessity remain empirical. But when it becomes possible to predict, in the case of man, the varieties of psychological temperament that will be found inhabiting these somas, we pass from the realm of measurement and averages, mixed with subjective judgment, to that of law: we are dealing with uniformity of behavior tied to measurable physical form. It is this accomplishment which has excited so much interest.

The temperaments which inhabit these forms bear descriptive names and are measured by laboriously determined scales, twenty features in each. If a person with marked resemblance physically to the endomorph pattern will read down the whole list of characteristics attributed to the viscerotonic type of temperament, he will recognize himself; so too the mesomorphic in the somatonic list, and the ectomorphic in the cerebrotonic list. Persons whose characteristics are distributed indifferently through the scale will naturally not enjoy this experience in themselves, but they may have the shrewd pleasure of identifying their acquaintances, and of understanding them much better than before.

The ectomorph (let us pick on the little fellow as our example!) has, says Dr. Sheldon, "long, slender, poorly muscled extremities with delicate, pipestem bones, and he has, relative to his mass, the greatest surface area and hence the greatest sensory exposure to the outside world. He is thus in one sense overly exposed and naked to his world . . . " Embryologically, we may point out, the ectoderm of the ovum gives rise not only to the skin, with which *in proportion to his volume* our subject is overendowed; it is also the source tissue (*anlage*) for that "other epithelium", the brain. And so the Sheldon scale for the cerebrotonic gentleman, living in this ectomorphic animal, naturally runs: Restraint in posture and movement, tightness; physiological over-response; overly fast reactions; love of privacy; mental overintensity, hyperattentionality, apprehensiveness, and so on. Let any pipestem pipsqueak who doubts, turn his thin skull and this page and look at the whole list!

We thus find ourselves in possession of a scheme of measurement of mankind which embodies, in one whole, embryological principles, physiological and anthropological standards and psychological characteristics. Further study will give us invaluable knowledge of development, understanding of types at all stages. The importance of such information for teachers is evident. The value to the philosopher, who should be the teacher's alter ego, is no less. The use of such a system to the sociologist is immediate.

With this solid ground gained in understanding of "normal people", and with the rapid growth of understanding of the importance of the psyche as causal source not less powerful than soma in adults, a question presses upon us all: When shall we have some general agreement as to the place of self-consciousness and the Ego-system or soul in the scheme of things? What new steps could be taken, or what older wisdom called upon, by which to restore soul and spirit as subject matter in psychology, so that from these admirably contrived new scales of soma and psyche we can go on to better recognition and even measurement of the true, the beautiful, the good, and the creative spirit which make us what we are?

The need, long evident, is now urgent to unite two attitudes displayed toward psychological method and subject matter which have been prominent in the United States for many years. One opinion is that psychology is a part of the natural sciences, measurement is the proper technique, and often then assumes that man is merely a peculiar mammal. Such psychology tends to become a science without a special subject matter, merely taking up the subtler parts of physiology for study. When pushed by the opposite party, the extreme environment-measurement men abandoned references to any features of man which elude their techniques, and thus they achieved a kind of justification for the low-level and selective materialistic monism which is characteristic of behaviorism. Writing at the peak of the popularity of this exclusive naturalism, W. E. Hocking observed (*Thoughts on Death and Life,* Harpers, 1937):

"Science is not in general responsible for the use which men make of its results, whether these users are technicians or thinkers. Science is concerned with facts, not with the value-meaning of these facts. As a body of truth, science stands as one great and indubitable moral achievement of our time. If men misinterpret it, that is their responsibility, not the scientist's.

"There is, however, one science of which this cannot be said with the same freedom, namely, psychology. The human mind is a pursuer of meanings and values; a science of the mind becomes, therefore, an inquiry into the entertaining of meaning. And the trend of this science has encouraged the public, and college administrations in America and Germany, to believe that it has light to throw on this theme.

"It is therefore obligatory upon us to note that in proportion as psychology succeeds in its ambition to become a natural science, just in that proportion it becomes empty-handed in respect to meanings. (In practice, the science of psychology is pulled in two directions: toward naturalism, perhaps in the form of behaviorism, which is one clear ideal, and toward a purposive description with introspective data. I am here speaking of pure instances of the first trend).* For the ideal of psychology as a natural science is to reduce the phenomena of the mind to patterns of behavior, which are in the last analysis events in the general history of energy.

"The entity called 'consciousness' may be there, but it is not to intrude into the picture as an explanatory factor. Nothing that happens happens because of consciousness and its desires; it happens because the pertinent law of brain-physiology requires this outcome. And since 'law' is not aware of what it does, and since all meaning is meaning *for consciousness,* meaning is eliminated from the scientific picture. Thus a natural-science psychology is, by necessity of its method, a description of the meaningful in terms of the meaningless."

While Dr. Hocking and many others were thus evaluating the behaviorist school, it was taking final steps to rid itself of every term which might restore to psychology its proper subject of inquiry. It may be well to remind readers how thorough-going this clearance has been, and how pervasive has been the influence of this school among present younger teachers of psychology. We may select as representative one book published in the very same year as that in which Dr. Hocking was speaking, and another dated four years after.

The index of *Fundamentals of General Psychology* by Dr. John Frederick Dashiell, University of North Carolina (Houghton Mifflin, 1937) does not contain the word consciousness, and only one reference to awareness where (page 371) bodily skills, typewriting and basketball throwing, are described as advancing by means of unconscious adaptation. Nothing appreciative is said here even of the low role of consciousness as critic in deciding what is better and what is worse. Self-awareness, the fundamental psychological distinction between men and animals simply does not exist for this school. How then do we learn? Obviously this comes not by attending. In learning it is not consciousness but "developmental motivation" which is important, and effects are the selective agency. That man alone among creatures seems to be able to compare effects objectively is merely ignored.

What are we to conclude from such writing? We can only suppose that this splendid work on general behavioristic psychology resulted from trial and error. We need not think that the author was unconscious during the process, simply that in him consciousness does not exist. If we follow his verbal system we would have to say that a long sequence of stimuli and of maximal and minimal clues has resulted in a book bearing a man's name. The publishers are presumed to be unaware of having issued this book, although they would probably defend the copyright. The reader perceives the volume as a fatigue stimulus (we are still using Dr. Dashiell's language, as well as we understand it); or, more properly, since perception is ambiguous, fatigue in the reader is evidence that a book exists. How then is progress made in learning? This goes on without advancing meaning, for "the whole phenomenon is reducible to the competition of two systematised sets of habits, each strongly built up in past experience. The success of the competitor depends upon relative fatigue, re-enforcing action-systems, and doubtless many other factors" (pages 337-338) — but apparently consciousness cannot be one of them.*

Thus in 1937 the divergence of the two attitudes was at the widest possible angle, and since then the opposite tendencies have continued their ways, adding at the intimate core of human affairs the ultimate in confusion. In 1941 Dr. Henry E. Garrett of Columbia University published his valuable *Great Experiments in Psychology* (Appleton-Century), in which no indicial reference is made to attention, awareness, consciousness, or effort. (Gestalt, being experimental, is dealt with, but merely as a way of organizing perception). The general editor of this series, Richard M. Elliott, opens his introduction to the first edition of Dr. Garrett's book with these words: "Is there in the college curriculum any subject in which it is more easy to interest the student, and more difficult to instruct him, than psychology?" To this question, in this setting, questions are the only appropriate response: Is there any other subject in the college curriculum which ignores the existence of attention, awareness, consciousness, and effort, while lamenting student inattention to instruction as compared with entertainment? Is there any other subject claiming autonomy which asks students to do without any special subject matter? If we deny the existence of willed and conscious attention, are we to reproach students for not displaying it?

We could all afford to regard this battle of the brains against the minds as entertaining, before the appearance of the gunpowder plot to blow up the parliament of the nations. It is no longer amusing. We are paying, now, and dearly, for the confusion and doubt introduced into the very heart of education. A small arc of

* In the original, these parenthetic words are a footnote. Ed.

* As an elementary work also published in 1937, free of this narrowing influence, we may mention *Personality, A Psychological Interpretation,* Gordon W. Allport, Associate Professor of Psychology, Harvard University, (Holt), wherein consciousness gets about seven pages, and the whole subject is sustained in an atmosphere of historical and philosophical breadth.

error at the center has become a large one further out. College faculties are worse off than Lincoln's contemporaries. They in 1856 were unable to see where they were, and hence unable to try to see where they should be going. We in 1946 do not even know, in the sense of general agreement, *what* we are, or even *if* we are! It is small wonder that a conspicuous group in higher education offers us a retreat to 1250 A.D. in order to get ethical force comparable to that which formerly was derived from religion. But is it fair to religion to make authoritarianism a substitute for philosophical conquest of our materials?

In present strange circumstances it is both disquieting and promising that the procedures with which to end European philosophic doubt, and our ethical breakdown, are all at hand, unused. Since 1897, the growth of science has stretched our vision to the horizon, the place where the celestial light of the heavens meets the firm earth. Gross matter, as known to science in the youthful years of the present generation which sits now in places of authority, has been dissolved away into a diaphanous veil, and we have communion through it with the most high. Law and order, form and function, chromosomes and enduring purpose, laws of electronic and planetary orbits, rational parameters and rules of complication in crystals, periodicity in the elements, geometric properties of the space-time-energy field — a sublime order encompasses us, and science has made amply clear a natural theology in which the European mind can at last end its paralyzing philosophic doubts. God as Law is known. This world of law turns out to be the same as that long since perceived by the sages, but now its reality is documented so fully that it can readily be displayed in campus courses, progressively impressive and consistently cogent.

For what, then, are we waiting in this eleventh hour in America when the conceptual, ethical, and now the functional breakdown of our society threatens to degenerate rapidly into irretrievable economic, political, and finally military exhaustion? What is still required to liberate us from the classical opposition of superstition and philosophic doubt as sterile limits?

We have only to restore meaning and values to psychology. The physical sciences have broken free. It gets clearer every day that statistical studies of randomness are only a human way of getting at knowledge of order that is real, through a study of averages in a disorder that is only apparent. Chaos, we now see, is as it should literally be taken, the void, not disorder but the behavior of atomic and electronic negation in a real and symmetrical matrix, as Gilbert N. Lewis indicates in *The Anatomy of Science* (Yale University Press, 1926). Biology is in a fair way to make its equal contribution to the required knowledge

THE SCALE FOR TEMPERAMENT

(Employed in the Sheldon studies of constitutional psychology, from page 26, *The Varieties of Temperament,* Sheldon and Stevens, Harper and Bros., New York, 1945. We acknowledge with thanks permission to reprint this scale in its entirety).

I	II	III
VISCEROTONIA	SOMATOTONIA	CEREBROTONIA . . . .
() 1. Relaxation in Posture and Movement	() 1. Assertiveness of Posture and Movement	() 1. Restraint in Posture and Movement, Tightness
() 2. Love of Physical Comfort	() 2. Love of Physical Adventure	— 2. Physiological Over-response
() 3. Slow Reaction	() 3. The Energetic Characteristic	() 3. Overly Fast Reactions
— 4. Love of Eating	() 4. Need and Enjoyment of Exercise	() 4. Love of Privacy
— 5. Socialization of Eating	— 5. Love of Dominating, Lust for Power	() 5. Mental Overintensity, Hyperattentionality, Apprehensiveness
— 6. Pleasure in Digestion	() 6. Love of Risk and Chance	() 6. Secretiveness of Feeling, Emotional Restraint
() 7. Love of Polite Ceremony	() 7. Bold Directness of Manner	() 7. Self-Conscious Motility of the Eyes and Face
() 8. Sociophilia	() 8. Physical Courage for Combat	() 8. Sociophobia
— 9. Indiscriminate Amiability	() 9. Competitive Aggressiveness	() 9. Inhibited Social Address
— 10. Greed for Affection and Approval.	— 10. Psychological Callousness	— 10. Resistance to Habit, and Poor Routinizing
— 11. Orientation to People	— 11. Claustrophobia	— 11. Agoraphobia
() 12. Evenness of Emotional Flow	— 12. Ruthlessness, Freedom from Squeamishness	— 12. Unpredictability of Attitude
() 13. Tolerance	() 13. The Unrestrained Voice	() 13. Vocal Restraint, and General Restraint of Noise
() 14. Complacency	— 14. Spartan Indifference to Pain	— 14. Hypersensitivity to Pain
— 15. Deep Sleep	— 15. General Noisiness	— 15. Poor Sleep Habits, Chronic Fatigue
() 16. The Untempered Characteristic	() 16. Overmaturity of Appearance	() 16. Youthful Intentness of Manner and Appearance
() 17. Smooth, Easy Communication of Feeling, Extraversion of Viscerotonia	— 17. Horizontal Mental Cleavage, Extraversion of Somatotonia	— 17. Vertical Mental Cleavage, Introversion
— 18. Relaxation and Sociophilia under Alcohol	— 18. Assertiveness and Aggression under Alcohol	— 18. Resistance to Alcohol, and to Other Depressant Drugs
— 19. Need of People When Troubled	— 19. Need of Action When Troubled	— 19. Need of Solitude When Troubled
— 20. Orientation Toward Childhood and Family Relationships	— 20. Orientation Toward Goals and Activities of Youth	— 20. Orientation Toward the Later Periods of Life

Note: The thirty traits with parentheses constitute collectively the short form of the scale.

of order, now order not only true and mechanical, but sentient and lovely, a cosmos expressing certain deeper levels of the matrix shared with the chaos. All that remains is for psychology to recognize even more profound sources at creative and virtuous levels in man, where the meaningful Logos can be one with the purposeful Cosmos of life, as that purposeful order is deeply one with the apparent—but only seeming—Chaos. In short, the final step is to see God intelligibly, as we have already seen God rationally.

Put directly to psychology the problem is whether man displays any attribute not displayed by other creatures; whether, if we admit this, we shall expand the meaning of the term Nature to include that unique phenomenon (consciousness) in order to continue psychology as a natural science, or to speak of the Universe as the larger framework; then we have to decide whether we shall suppose that law runs throughout Nature but not throughout the Universe; and finally we must inquire of ourselves whether we believe science or even exact science is co-terminous with measurement as now known. These very old matters have today become the most urgent of business, since confusion, which is a conspicuous feature of literate ignorance and the fertile soil of fascism, is coming to its peak. But they are altered by new knowledge. Formerly the question was: Is natural identical with physical? This question was later framed: Is natural identical with material? Since Einstein's equation gained acceptance we know that matter and energy are interchangeable concepts, and that the universe displays the ideal along with the energetic. What this means to psychology is to be seen. Gestalt closures seem to show that meaning belongs to energy and consciousness to the ideal. Both may be measurable but the latter only by a metric of its own, as Betts long ago suggested. Prodigious, serious, and socially important work has to be done, and done in a spirit of humble simplicity, and with eagerness to help the human race. Faculties have to come to some sort of working agreement as to how they shall use terms about man. This need not stifle "freedom of opinion." We require only that the student be conscious of the present situation, as to knowledge in psychology. This leaves *him* free to decide, and not confused to the point of despair and cynicism, at the core of his own being.

The work to be done has hitherto been difficult to define because it involves labors close in at the heart of the human constitution. A decisive step would be the discovery and general acceptance of proof of the causal-ideal nature of consciousness operating upon the body in the autonomic system, including the system of chemical control. Studies of biochemical and biophysical correlates are many: psycho-galvanic skin reflexes, blood and saliva changes, the hormone effects, electroencephalograph studies of the Berger rhythm, and the like. But still to be found is the explicit evidence of the free, causal, and deliberate intervention of willed attention. To satisfy all parties, this bodily effect must be measurable, and to be conclusive there must be an accompanying effect in the psyche, to show that consciousness is not merely psyche. Such studies would make psychology a natural science in the contemporary sense, but would retain meaning and values. Since we need this modernization, what is involved should be here identified.

In physics we have today measurements interpreted within a metric. The metric is ideal. The role of the ideal was admitted by Newton himself. A body in motion will continue in a straight line with unchanged velocity, *unless* . . . We have to realise that this is taken as a fundamental truth although no observable instance occurs in Nature. Einstein's contribution was to make clear the need for an ideal metric suited to this truth, when he proposed that the gravitational potential is not scalar. What that metric should be to fit the over-all dynamic system to be measured is not yet settled. He and many others are still working to determine what is Nature's metric for gravity and electromagnetism. But at least we now know where we stand as to metric ("ideal") and dynamic ("real"). There is an "ideal" system of a four-dimensional variety, at the least, and in it energy "really" works. The motion in a straight line is the geometric ideal, and it is the primarily kinetic fact. The alteration of the motion is the secondary dynamic factor. This new philosophical outlook has overwhelming pragmatic sanction, and it is not a duality, nor is it a weak idealism. The ideal is the primary, and energy is a secondary, but both are universals.

If we mean to have a natural science psychology *in these new terms,* we have to expect that there will be a primary, ideal, universal, metric element in man, and it has to be the same as that in Nature. The question for psychology is not as simple as for physics, for the operation of the dynamics of the bodily process against a background of the metric may be accompanied in man by a deep psychological root that touches the metric directly. In fact, this must be so, for man's abstract mind and his consciousness together allow of his identifying the metric, while his bodily form and function operate and are measurable within it. Nor is this all. There is the psyche, which has been appearing throughout evolution as form (crystalline), sentience (plant) and mind (animal), until in the contemporary domestic animal there is mind almost co-equal with man's concrete mind, but neither self-consciousness, nor abstract thought.*

If we are to continue to be contemporary natural scientists in psychology, this in-between world must be taken as either real or ideal, that is either scalar or metric, or both. Let us simplify and say it is one or the other. Then it must be dynamic and measurable, and we see it so in its working in the depth psychology

* In *Biological Abstracts,* 20 (609), Dr. N. Rashevsky, University of Chicago, summarizes an article by himself on *The Mathematical Biophysics of Some Mental Phenomena* in the *Bulletin of Mathematical Biophysics,* 7(3): 115-131, 1945, discussing "some aspects of the mathematical biophysics of the central nervous system, which hitherto have not been treated." "First, a neurobiophysical mechanism for consciousness is suggested. It provides for the possibility of conscious and unconscious reactions. Next, a mechanism of memory, both on the conscious and the unconscious level, is suggested . . . On the average, an exponential decay of memory with time is obtained, although memory of unusually strong experiences follows a somewhat different law of decay . . . Finally, a mechanism for foresight and desire of future events is suggested." We have not yet seen the original. Ed.

and in psychosomatic medicine. This leaves consciousness as an attribute of the ideal, the geometric, even if reduced to a monadic point. Hence we have, in man as a post-Einstinian concept, three entities, at least, not two, as in physics: The metric or ideal, a psycho-dynamic system, and a somo-dynamic organism. The difference between the two latter is that the last named has the majority of the mass and the statics (morphology), and the psyche has apparently little if any mass, higher velocity, and hence the greater kinetics which works out as functional supremacy.

We would then expect to find proof of the causal intervention of consciousness — the altering of things outward by the expression in the dynamic systems of an ideal metric — to take the form of a bettered reordering of the psyche, with measurable therapeutic effects in the body. The instrument Nature has devised for the physical expression of the dynamism of the psyche is the autonomic system. Here in the vegetative apparatus the psyche is most at home. The device which has appeared along with consciousness, the soul or Ego-system, may be located in the central nervous system, but the precise location is unknown and must be looked for. It is presumably in the cortex. Giant Betz cells are most numerous in man, and next most numerous in a descending scale in the domestic animals. But consciousness and its creations may not have a limited anatomical location. All we need to say is that pictured movements and other skills, sentiments, philosophy, and the rest of higher personality certainly have some special association with the central nervous system in man.

In simple terms, finally, the issue is whether or not we can measure consciousness in the body taking over the autonomic system, and if so in what degree; and if, and when, it does so, do we have a heightened ideal (geometric) system of order in the psyche and in the soma, or no? If the psyche and the soma both show a greater degree of regularity of function and of material balance, then the psychological parallel to the present situation in physics is complete, and it allows for man's peculiar situation. As consciousness he trades directly with the ideal and metric; he is the master of spherical harmonics, geometries "reasonable and unreasonable", and the like. He is a citizen of the universe. Religion then consorts with sense. As psyche and soma, man is tied into Nature, and especially terrestrial Nature, and is a citizen of this entire planetary world — though deceived by his psyche, so light in mass, and by his body, so conditioned to local form, into supposing himself a Russian, a Chinese, an American, an Indian, or some other local phenomenon.

We are privileged to print in this issue of MAIN CURRENTS the report and documentation of an original investigation by Dr. T. Brosse into measurable effects of concentration and of consciously willed control of the arterial wave. The past hundred years have afforded such critical experiments as those of Gregor Mendel with sweet peas, or William Stanley with the tobacco mosaic virus, which served the one to introduce a new element of integral order into biology the other to draw the crystal kingdom alongside plants and animals. Together Mendel and Stanley gave biology adequate independence, starting us out on the study of the aperiodic crystal, and enabling us to extend geometry, from the crystal space-lattices right through the morphologies of the other two kingdoms. Dr. Brosse's investigation of the role of consciousness in relation to breath and pulse may or may not prove to be the start of work equally decisive, this time as a service in freeing psychology from exclusive physiological domination imposed by theoretical psychologists running far beyond their own findings. Such freedom has long since been demanded by physicians who have come to recognize the causal power of the psyche in general, in functional diseases studied in psychosomatic medicine.

That portion of Dr. Brosse's work done in France constitutes by itself an advance beyond any study, known to us, so far made of the causal role of consciousness. As the cardiogram studies of yogis are a more complex affair, the reader is referred to, *Yoga, A Scientific Evaluation,* Macmillan, 1937, for an account of the last previous effort in this field. The author of this work, Kevoor T. Behanan, was born in Travancore, India, took a Bachelor's degree at Calcutta University in 1923, and spent two years in government service in Madras Presidency. After a year given to the study of philosophy at the University of Toronto, he commenced a stay at Yale, which was rounded out (for purposes of his book) by a visit to India on a Sterling Fellowship, in 1931. There he gave a year to systematic discipline in yoga practices, and upon his return offered the present book at Yale for a doctor of philosophy degree in 1934.

It contains a useful discussion of important features of Indian philosophy in the first 140 pages. Then come two chapters on yoga and psycho-analysis and yoga and psychic research. The remainder is devoted to postures, breathing, and concentration exercises, concluding with an appraisal. For present purposes the material of most interest is the study of oxygen consumption in three varieties of breathing, *ujjayi, bhastrika* and *kapalabhati,** out of the nine described in the classical works.

Dr. Behanan offers us no measurement data upon the relation of breathing and concentration to pulse, and it is here that the greatest interest centers from the point of view of psychology and of philosophy. If the intervention of consciousness can be shown to have a specific kind of effect upon the arterial stream, it is clear that we must accept some sort of causal connection from conscious to unconscious. This having been demonstrated, further claims of yogis become reasonable and important for study.

One of these requiring investigation is that a system of psychic organs (*chakras*) exists, vital and emotional in their present chief meanings and functions. The locations of these organs in reference to bodily anatomy have long been settled in the classical yoga books. [The reader may consult *The Serpent Power,* Arthur Avalon (Sir John Woodroffe), Ganesh and Co., Madras, 1924]. Western experimental anatomy has located the endocrine glands, important organs of chem-

* Kapalabhati is a simple, shallow, preparatory type of breathing; the others are *ujjayi, bhastrika, suryabhedana, sitkari, sitali, bhramari, marchchha.* Each differs by the ratio of the period of inhalation (*puraka*), to suspension (*kumbhaka*), and to exhalation (*rechaka*) of the breath.

ical control, at these points. These form a chain from the pineal body and the pituitary at one end of the series, to the coccygeal gland at the very end of the spinal cord, a terminal body the size of a millet seed, and histologically like the chromaffin group of endocrines. The endocrines have long been known to be a system as important for functional regulation as are the several parts of the nervous system. Their relation to the emotions is also fully established clinically, and it is important to note that emotional equilibrium is a central feature of the practice of yoga.

The endocrines are called the ductless gland system because, unlike the lymphatics, they discharge only into the blood stream. The significance of possible conscious intervention not only into the breath cycle, but into the pulse cycle as well, now becomes apparent. May we reasonably suppose we have here, in yoga, a technique for reaching the endocrine system, and of regulating it by various rhythms in oxygenation and various degrees of arterial service, while in the psyche emotional richness and cheerful calm are sustained? The yogi is attacking the autonomous system from two sides: psychic and somatic; and in two ways: by a simpler order of preparatory exercises directed to the subjugation of the principal mass of striated muscle, and a more advanced series of techniques directed to the control of that strange muscle, the heart (which belongs strictly neither to smooth nor striated groups), the lungs, the oxygenation of the blood, and finally the endocrines. This whole development forms an impressive instance of envelopment in attacks upon problems which we of the west approach from the side, and in which we tend to take sides. The meeting of these streams of human effort upon a basis of mutual respect is an event long overdue.

The impending reorganization of psychology as a whole begins to take clear outline. For one thing, psychology of the normal types can be set up, and freed a good deal from the implications of pathological psychology. Then philosophical aspects begin to appear. Here the Grant Study Fund labors* at Harvard and Sheldon's work serve by establishing the three types, cerebrotonic, somatonic, and viscerotonic upon physical foundations which trace back to the three germ layers, where the philosopher may see the faint form of a microcosm doctrine. Next, psychosomatic medicine having dissociated, and equalized causally, psyche and soma, we are able to assign the behaviorists to physiology. Again, as to the psyche on its own account, the depth psychology, psychoanalysis, and psychiatry generally, with its Rorschach tests resting upon animal and even sexual significance of bilateral symmetry in ink blots and using also forms of freer association, are available to build up an account of the vital or sexual, the herd or emotional, and the egotistic or critical-mental complexes. Here are *functions* as clearly defined as the skeletal, sinovascular, or other bodily *systems.* The place of Freud is secure in having established the general position; the work of Jung and others in having broadened our understanding of the role of the unconscious.

This puts us in a position to re-evaluate parapsychology. When the Society for Psychical Research did its original work there was no organized depth psychology nor developed Gestalt system to apply to the findings. Hence such a work as F. W. H. Myers' monumental two volumes on *Human Personality* could not be placed. It has been nearly lost to view. Today we can attack afresh the old and the new data on hypnosis, extra-sensory perception and the like from Harvard, Duke, Leyden, and elsewhere.

Now the little understood powers of religious experience come into ken and can be made reasonable. If there is a higher range of experience possible to man as part of our future evolution, available at once by forced development in yogis or by simple virtue in saintly persons, it should bring with it a more adequate understanding of order and with this it is equally reasonable to expect occurrence of exaltation and serenity. To this all true seers and mystics have borne witness; and those who have observed such persons have testified to the secret springs of joy. Once we can distinguish clearly between fanaticism and escapism disguised as religion, with scape-goat mentality and fictitious zeal, place may be made for genuine experiences. The repression of true religious experience is sure to lead to the deepest of disorders, just because there has been contact in a healthy person with the deepest level of order. Here we touch upon an inadequate aspect of modern life in the West, where the excesses of disbelief and of religious formalism are quite as erroneous and may be as great evils as the superstitions we attribute to older societies. Even in mathematics the intuitional runs before the logical proof, which is brought up afterward to secure a position taken by a power of the soul which feels at all times its oneness with the sublime order. Because in mathematics we can usually justify and consolidate the gain, we prize the intuition therein. Why then suspect it in its work of intelligible communion with its own frame of reference in other matters?

Studies of the human soul, as such, not merely the parts of the psyche common to men and mammals, have begun with Gestalt experimental evidence for meaningful and aesthetic closure as functions of the will in ambiguous figures. Beyond that we come at last to consciousness in its own right, the simplex witness of the whole great complex. We verge upon the Socratic Daimon, the creative spirit deeper in the heart of nature than virtue or soul can possibly be; and a solution of the problem of sin, so-called, becomes feasible if it be seen as frustrated creative power, and dissociated from sexual and reproductive urges. The work of Edmund Husserl begins to count now. The social meaning of such a clearance of the guilt complex in the present world crisis was discussed by Dr. C. B. Chisholm in his William Alanson White lectures this year (*Psychiatry*, February, 1946).

* Dr. Carl C. Salzer in the *Journal of Psychosomatic Medicine*, March-April, 1946, says:—"For an extended review of this subject and excellent bibliography, see Tucker, W. B. and Lessa, W. A. Man: A Constitutional Investigation. Quart. Rev. Biol., 15:265-289, 411-455, 1940. For a description of the work of the Grant Study see Wells, F. L.: A Research Focused upon the Normal Personality: A Note. Character and Personality, vol. 12, no. 4, pp. 299-301, 1944; Heath, Clark W. et al.: What People Are. Introduction to the work of the Grant Study, Harvard University Press, 1945; Hooton, E. A.: Young Man, You Are Normal. Putnam, 1945."

In such a reorganization we may be able to arrive at a conceptual spaciousness which will give proper place to Eastern wisdom without in any degree compromising scientific standards. In fact, it may be necessary to improve these, for Buddha, in common with all other sources of the real "higher learning", declares that the Sages but live out the universal law. We moderns have too little law to embody in life, as our science has been long inadequate at the level of life and consciousness. Hence our ethics are still drawn overly much from personal sources. No doubt these, though traditional, are entirely compatible with the ethics of the universal harmony. But where the moral and the natural laws meet and are one much work has yet to be done. It is not being done in any adequate modern sense by retreat to one mediaeval and outmoded intellectual interpretation, a process the antithesis of seeking the truths of comparative religion, and a reversal of historical and scientific method — nor by a do-nothing policy even more defeatist, which contents the other academic party.

There is a great enterprise yet to be undertaken somewhere with serious and sustained resolution: the identification and publication of the principles of the arts, the universals of philosophy, the truths of comparative religion, and the laws of nature as projected along the moving frontier of science. What work could be more inspiring and more fruitful to the laborers, and more satisfying to those who might be found to implement it with funds?

In the doing we could come to better understanding with India, the heir to Eastern insight, the chief reservoir of the races' contemplative gains, at one extremity; and at the other with Russia (where scientific standards have most social force), just because the Soviets are mid-placed as to their geography and their mystical and aesthetic inheritance, between East and West. Thus through integration, prompted and piloted by a sweeping clearance in psychology, world settlement will be directly served. The conceptual breakdown, which has lead to an ethical breakdown, and now has brought about a social breakdown, may still be arrested in its worse effects by working at the very foundations. If this be doubted, at least it may be admitted that by intense and prompt work at the level of higher education we can steady the nation for the days of trial ahead. And we may, while working, begin to see that it is not impossible, were money enough spent to accelerate the work, that we could halt the descent from conceptual, to ethical, and to social confusion, before it goes on to irretrievable economic, political, and finally military exhaustion.

GRADUATION, EVOLUTION, and REINCARNATION

Ananda K. Coomaraswamy

The so-called conflicts of religion and science are, for the more part, the result of a mutual misunderstanding of their respective terms and range. As to range: one deals with the why of things, the other with their how, one with intangibles, the other with things that can be measured, whether directly or indirectly. The question of terms is important. At first sight the notion of a creation completed "in the beginning" seems to conflict with the observed origin of species in temporal succession. But *en arche, in principio, agre* do not mean only "in the beginning" with respect to a period of time, but also "in principle," that is, in an ultimate source logically rather than temporally prior to all secondary causes, and no more than after the supposed beginning of their operation. So, as Dante says, "neither before nor after was God's moving on the face of the waters"; and Philo, "at that time, indeed, all things took place simultaneously . . . but a sequence was necessarily written into the narrative because of their subsequent generation from one another"; and Behmen, "it was an everlasting beginning."

As Aristotle says, "eternal beings are not in time." God's existence is, therefore, *now*—the eternal now that separates past from future durations but is not itself a duration, however short. Therefore, in Meister Eckhart's words, "God is creating the whole world *now*, this instant." Again, no sooner has some time elapsed, however little, but everything is changed; *panta 'rei*, "you cannot dip your feet twice in the same waters." So, then, as for Jalalu'd Din Rumi, "every instant thou art dying, and returning; Muhammad hath said that this world is but a moment . . . Every moment the world is renewed, life is ever arriving anew, like the stream . . . The beginning, which is thought, eventuates in action; know that in such wise was the construction of the world in eternity."

In all this there is nothing to which the natural scientist can object; he may, indeed, reply that *his* interest is confined to the operation of mediate causes, and that it does not extend to questions of a first cause or of the whatness of life; but that is simply a definition of his self-chosen field. The Ego is the only content of the Self that can be known objectively, and therefore the only one that he is willing to consider. His concern is only with behavior.

Empirical observation is always of things that change, that is, of individual things or classes of individual things; of which, as all philosophers are agreed, it cannot be said that they *are*, but only that they become or evolve. The physiologist, for example, investigates the body, and the psychologist the soul or individuality. The latter is perfectly aware that the continued being of individualities is only a postulate, convenient and even necessary for practical purposes, but intellectually untenable; and in this respect is in complete agreement with the Buddhist, who is never tired of insisting that body and soul — composite and changeable, and therefore wholly mortal — "are not my Self," not the Reality that must be known if we are to "become what we are." In the same way St. Augustin points out that those

who saw that both of these, body and soul, are mutable, have sought for what is immutable, and so found God, — That One, of which or whom the Upanishads declare that "That art thou." Theology, accordingly, coinciding with autology, prescinds from all that is emotional, to consider only that which does not move, — "Change and decay in all around I see, O Thou who changest not." It finds Him in that eternal *now* that always separates the past from the future and without which these paired terms would have no meaning whatever, just as space would have no meaning were it not for the point that distinguishes here from there. Moment without duration, point without extension — these are the Golden Mean, and inconceivably Strait Way leading out of time into eternity, from death to immortality. I used the word *"consideration"* just now; it will be worthwhile to remember that it meant originally just what we now call astronomical observation, but with a view to the discovery of the ultimate cause or principle of sidereal motion rather to its measurement alone.

Our experience of "life" is evolutionary: *What* evolves? Evolution is reincarnation, the death of one and the rebirth of another in momentary continuity: *Who* reincarnates? Metaphysics prescinds from the animistic proposition of Descartes, *Cogito ergo sum,* to say *Cogito ergo EST;* and to the question, *Quid est?* answers that this is an improper question, because its subject is not a what amongst others but the whatness of them all and of all that they are not. Reincarnation—as currently understood to mean the return of individual souls to other bodies here on earth — is not an orthodox Indian doctrine, but only a popular belief. So, for example, as Dr. B. C. Law remarks, "it goes without saying that the Buddhist thinker repudiates the notion of the passing of an ego from one embodiment to another." We take our stand with Sri Sankaracarya when he says, "In truth, there is no other transmigrant but the Lord," — he who is both transcendently Himself and the immanent Self in all things, but never Himself becomes anyone; for which there could be cited abundant authority from the Vedas and Upanishads. If, then, we find Krishna saying to Arjuna, and the Buddha to his Mendicants, "Long is the road that we have trodden, and many are the births that you and I have known," the reference is not to a plurality of essences, but to the Common Man in everyman, who in most men has forgotten Himself, but in the reawakened has reached the end of the road, and, having done with all becoming, is no longer a personality in time, no longer anyone, no longer one of whom one can speak by a proper name.

The Lord is the only transmigrant. That are thou, — the very Man in everyman. So, as Blake says:

"Man looks out in tree, herb, fish, beast, collecting up the scattered portions of his immortal body . . .

Wherever a grass grows or a leaf buds, the Eternal Man is seen, is heard, is felt,

And all his sorrows, till he reassumes his ancient bliss,"

like Manikka Vacagar: "Grass, shrub was I, worm, tree, full many a sort of beast, bird, snake, stone, man and demon . . . In every species born, Great Lord! this day I've gained release,"

Ovid: "The spirit wanders, comes now here, now there, and occupies whatever frame it pleases. From beasts it passes into human bodies, and from our bodies into beasts, but never perishes,"

Taliesen: "I was in many a guise before I was disenchanted, I was the hero in trouble, I am old and I am young,"

Jalalu'd Din Rumi:

"First came He from the realm of the inorganic, long years dwelt He in the vegetable state, passed into the animal condition, thence towards humanity: whence, again, there is another migration to be made,"

Aitareya Aranyaka:

"He who knows the Self more and more clearly is more and more fully manifested. In whatever plants and trees and animals there are, he knows the Self more and more fully manifested. For in plants and trees only the plasm is seen, but in animals intelligence. In them the Self becomes more and more evident. In man the Self is yet more and more evident; for he is most endowed with providence, he says what he has known, he sees what he has known, he knows the morrow, he knows what is and is not mundane, and by the mortal seeks the immortal. But as for the others, animals, hunger and thirst are the degree of their discrimination."

In sum, in the words of Faridu'd Din 'Attar:

"Pilgrim, Pilgrimage, and Road was but Myself toward Myself."

This is the traditional doctrine, not of "reincarnation" in the popular and animistic sense, but of the transmigration and manifestation of "the Ever-productive Nature": it is one that in no way conflicts with or excludes the actuality of the process of evolution as envisaged by the modern naturalist. On the contrary, it is precisely the conclusion to which, for example, Erwin Schrödinger is led by his enquiry ino the facts of heredity in his book entitled *What is Life?* In his concluding chapter on "Determination and Freewill," his "only possible inference" is that "I in the widest meaning of the word, that is to say every conscious mind that has ever said or felt 'I' — am the person, if any, who controls 'the motion of the atoms' according to the Laws of Nature . . . Consciousness is a singular of which the plural is unknown."

Schrödinger is perfectly aware that this is the position enunciated in the Upanishads, and most succinctly in the formulae, "That art thou . . . other than Whom there is no other seer, hearer, thinker or agent."

I cite him here not because I hold that the truth of traditional doctrines can be proved by laboratory methods, but because his position so well illustrates the main point I am making, namely that there are no necessary conflicts of science with religion, but only the possibility of a confusion of their respective fields; and the fact that for the whole man, in whom the integration of the Ego with the Self has been effected, there is no impassible barrier between the fields of science and religion. Natural scientist and metaphysician: one and the same man can be both; there need be no betrayal of either scientific objectivity on the one hand or of principles on the other.

Lunacy in Maple Trees

In Yale *Journal of Biology and Medicine,* **16, 249,** 1944, Dr. Harold Saxton Burr reports a first attempt to examine the impact of many environmental forces, both local and universal, on the continued existence of a single living form, a maple tree. The impact of these environments has been recorded, using electromagnetic technic continuously, day and night. The results of the first three months are here presented and others will appear as the experiment continues.

The August recordings were taken from a tree in the town of Lyme, Connecticut, during the summer of 1943. The November records were taken from a tree in New Haven, Connecticut, in the fall of the same year. The records show a very characteristic diurnal rhythm to be found, however, only in selected cases, since other factors frequently obscured the pattern. In the early morning, from two to four hours before sunrise, the potential difference was at a maximum. From that time the potential dropped without interruption until the afternoon. Without going into the cause of this rhythm, it looks as though the tree were storing electrical energy, beginning with the sunset, with the maximum amount stored appearing in the early morning.

Further study of the continuous recording displayed another astonishing fact. There is a curious rhythm, inasmuch as there occurs approximately every thirty days a tremendous and very sharp rise in the potential difference. In between these peaks of potential difference there are short periods during which the potential difference is very low. When the temperature, humidity, barometer and weather are plotted against these changing potential differences, it becomes clear at once that none of these environmental phenomena is related in any significant way to the electrical manifestations. The first peak occurs at or shortly after the phase of the new moon. Ten or more days later the second peak occurs in the immediate vicinity of the full moon. On the basis of the evidence so far collected, one could predict by means of electrical measurements the changing lunar phases within forty-eight hours. These studies in their present preliminary state offer another evidence of order in the Universe upon which a relatively simple living system is in some degree dependent.

Warts Wished Away

"Warts are benign epitheliomata caused by a virus," but they can be eradicated by suggestion, and in *Psychosomatic Medicine,* March-April, 1946, Dr. Hermann Vollmer (from whom we quote and digest this information) reports methods used by him to remove them. He recites lists of considerable length, which give an idea of the medical remedies that have been applied, and the procedures, incantations, and applications employed by laymen. "The literature on this subject is quite confusing. One fact repeats itself throughout all the publications. A certain treatment found highly effective by one investigator proved to be entirely disappointing to another." "The only acceptable explanation . . . is a suggestive influence of the person who applies the treatment." What the treatment may be is to be determined by what is likely to impress the patient. Dr. Vollmer himself used a variety. In some cases he inspected and counted the growths, painted them with a blue (or red) fluid, provided a diagram of the warts in a drawing which the child could study, told his patients not to touch the warts themselves, that they would feel a tingling as proof that the treatment was having effect. If the child said the tingling was present, it was a sign the *suggestion* had taken effect. He varied his procedure in various ways, including injecting toxoid for immunization from diseases quite other than warts, but declaring to the child that this was the cure for them. He concludes, about method: "The creation of a certain atmosphere seems to be more important than the choice of the dye or apparatus . . . A noisy clinic or an overcrowded office with an efficient nurse going back and forth . . . is not a suitable place for such a performance. Neglect of these factors invariably results in failure. The physician has to take his time, has to be in a proper state of mind, has to concentrate and to be convinced of what he is doing."

Psychostomatics

A very solid landmark in the study of psychosomatic functions is that unique work, *Human Gastric Function,* by Dr. Stuart Wolf and Dr. Harold G. Wolff (Oxford University Press, 1943), a study (through a gastrostomy) of the behaviour of the stomach in the case of a proud and sensitive man who submitted himself to close scientific study in 1942. We have in this instance a combination of unexampled advantages to settle once and for all the precise reaction in the stomach to psychic strain: the case comes to hand after a series of similar cases with permanent openings into the stomach has long been on record; the subject put himself in the hands of a crew of investigators well qualified and well situated; his own nature was exactly suited to reveal the psychological aspect important to this work. As a consequence it may be said fairly that those who have any lingering doubts as to the originating powers of the psyche in bringing about bodily changes can be made converts to psychosomatics by means of irrefutable psychostomatics. In this study a scale of redness for the stomach mucosa was set up, and as a direct result of incidental and strong emotional frustrations, worries, conflicts, variations as high as twenty percent above the normal of control periods were observed. Exact correlations of pallor and blushing of the face were made with conditions in the stomach, showing general and diffused

effects in the body, of feelings entirely verbal or economic or domestic in their origin. In short, the authors supply us with a full account of the psychological history of their subject, detailed descriptions of particular unforeseen causes of specific emotional disturbances, measurements of changes brought on by them deliberately and shifted up and down a scale of intensity while they made observations, results of various dietary and medication experiments, and the like. Small wonder that Walter B. Cannon was prompted to say: "I venture to declare . . . that the functions of the stomach have never been investigated with the detailed care, the skill and ingenuity, that have been displayed in the researches carried out by the authors . . ." And since, as he also observes, "every man has a stomach, unless . . . the surgeon has been allowed to remove it," the reader of this book comes away from it with the final conviction that though he *has* a stoma in his soma he most likely *is* a psyche.

Man A Conditioned Logos

When linguists became able to examine critically and scientifically a large number of languages of widely different patterns, their base of reference was expanded; they experienced an interruption of phenomena hitherto held universal, and a whole new order of significances came into their ken. It was found that the background linguistic system (in other words, the grammar) of each language is not merely a reproducing instrument for voicing ideas but rather is itself the shaper of ideas, the program and guide for the individual's mental activity, for his analysis of impressions, for his synthesis of his mental stock in trade. Formation of ideas is not an independent process, strictly rational in the old sense, but is part of a particular grammar and differs, from slightly to greatly, as between different grammars. We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized by our minds — and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way — an agreement that holds throughout our speech community and is codified in the patterns of our language. The agreement is of course, an implicit and unstated one, *but its terms are absolutely obligatory;* we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees.

This fact is very significant for modern science, for it means that no individual is free to describe nature with absolute impartiality but is constrained to certain modes of interpretation even while he thinks himself most free. The person most nearly free in such respects would be a linguist familiar with very many widely different linguistic systems. As yet no linguist even is in any such position. We are thus introduced to a new principle of relativity, which holds that all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar, or can in some way be calibrated.

What surprises most is to find that various grand generalizations of the Western world, such as time, velocity, and matter, are not essential to the construction of a consistent picture of the universe. The psychic experiences that we class under these headings are, of course, not destroyed; rather, categories derived from other kinds of experiences take over the rulership of the cosmology and seem to function just as well. Hopi may be called a timeless language. It recognizes psychological time, which is much like Bergson's "duration," but this "time" is quite unlike the mathematical time, t, used by our physicists. Among the peculiar properties of Hopi time are that it varies with each observer, does not permit of simultaneity, and has zero dimensions, i.e., it cannot be given a number greater than one. The Hopi do not say, "I stayed five days," but "I left on the fifth day." . . . Whorf, B. L., *Science and Linguistics, The Technology Review,* Vol. XLII No. 6, April 1940.

Psychogenic Fever

In the *American Journal of the Diseases of Children,* 67, 176, 1944. Dr. Harry Bakwin describes infants who after remaining in the hospital, developed fever, which persisted for months. The usual temperature range was between 101 and 103 degrees Fahrenheit. No definite cause for the fever could be found. Sulfonamide therapy was without influence. A striking feature was the prompt drop in temperature when the patients returned to their homes. The author believes that either the prolonged fever of hospitalized infants is primarily psychogenic or that psychogenic factors lead to a prolongation of fever which is primarily infectious in origin. He bases his thesis on the fact that hospitalized infants show definite evidence of emotional deprivation and on the prompt disappearance of fever when the infants are transferred from the impersonal environment of the hospital to the personalized atmosphere of the home.

Equilibria

Experiment has shown that the amount of water a dog will drink equals its bodily deficit of water; also that the animal's urinary system further eliminates quite precisely any physiological excess. Further experiments have shown the same relations in frogs, earthworms, and one species of ciliate protozoa. The equilibrium of water content thus observed is an example of very many equilibria, perhaps as many as a thousand, maintained in every organism. How all these were established in such a fashion as to be maintained without mutual interference throughout the long duration of life is a matter for speculation. [H. F. Copeland, digesting an article on *The Self-Maintaining Organism,* in *Scientific Monthly,* 61(1): 57-62, 1945, for *Biological Abstracts,* Vol. 20 (387)]

A PSYCHO-PHYSIOLOGICAL STUDY

Thérèse Brosse

Every practicing physician knows from observation that as emotion aggravates diabetes, or epilepsy, or eczema, so will an emotional shock release by its repetition not only the gamut of aches and pains and fainting spells, but also arterial spasms and more objective disturbances of rhythm. As progressive intoxication brings a train of effects, so the slow traumatic effects of the emotions bring about functional crises in a healthy organism and exaggerate them in an unhealthy one. A burst of joy or a fit of anger can result in an oedema of the lung, a stroke, even a fatal fainting spell. On the other hand, conscious will can intervene to permit the organism, even while suffering from an organic disease, to make an effort apparently no longer within its capacity. Thus one can observe purely functional diseases disappear completely in patients when life brutally demands of them an effort of concentration requiring the full play of their energies at different levels.

In reference to the circulatory system, interesting experimental conclusions were reported in 1914 by the physiologist Wenckebach, who established the relationship between respiratory arrhythmia and the activities of consciousness. Sustained attention diverts the arrhythmia or makes it disappear. Inattention induces it or exaggerates it. In this connection the author reports the curious observations of the psychiatrist Wiermsa that melancholics (whose psychic activity is intense) have a regular cardiac rhythm; neurasthenics (whose attention is variable) suffer a great deal from respiratory arrhythmia. Wiermsa observed two students, suffering from this arrhythmia, in whom it disappeared during the examination period when their cerebral activity was at its maximum. Thus by the condition of the pulse it was possible to measure the intensity of conscious concentration. Respiratory arrhythmia (sinus arrhythmia) is physiological in childhood and youth, the age when thoughts wander. This same condition is to be found among animals, and in those human subjects whose mind and emotions are not directed by conscious autonomy, whose cerebral activity is closer to the lower mammals. Seen in the light of these data, respiratory arrhythmia appears, according to the conception of Frederick Muller, as a reflex controlled by the stimulating or inhibiting action of the higher centers. In the same way as in the eliciting of the common patellar reflex, the attention of the subject must be diverted if the physician is to detect it. When the connections with the cortex are interrupted, it becomes exaggerated.

It is in order to fix exactly this role of conscious dynamism in physiology in general, and more particularly circulatory physiology, that we conducted at the Broussais Hospital the series of experiments whose technique and results will be briefly noted.

In a series of subjects either normal or neurotic and showing sometimes a regular pulse, sometimes a variable type of arrhythmia (respiratory, sinusal, systolic), we asked each subject to perform an act of clear conscious concentration, such as a mental multiplication or the recall of a pleasant memory. The humeral or radial arterial tracing, recorded either on smoked paper or on the photosensitized paper of the electrocardiagram at the same time as the latter, was taken without discontinuity before, during, and after the experiment. The record shows among the patients two types of psychic reactions. While some performed this test correctly, others, being disturbed, divided their attention between fear and mental application and thus exaggerated experimentally their state of emotional diffusion. We were able therefore to record the arterial reactions during concentration, on the one hand, and during the period of emotion, on the other. The results were as follows:

1. With the neurotics predisposed to functional arrhythmias, concentration caused the arrhythmia to disappear from the record during the experiment. (Plates 1, 2, 3) Diffused emotion accentuated it or made it appear when the pulse was regular during the preceding moments. (Pl. 4) On the succeeding trial, the subject, in the act of concentration, corrected an arrhythmia which had been induced by the emotional upset of the first attempt.

Editorial note: The author of this study was Interne des Hôpitaux de Paris, 1926, and became Docteur en Médicine de la Faculté de Paris 1931. She was appointed Chef de clinique cardiologique à la Faculté de Médicine de Paris in 1936. Dr. Brosse has received the Médaille de la Résistance (1945), as the most recent of a series of distinctions. She is at present in the United States upon a medical mission authorized by the French Government.

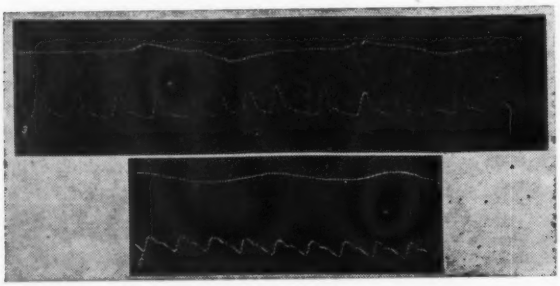
The original investigations, made in Paris, will be found reported (*inter alia*) in *La Pratique Médicale Française*, February, 1937, in *Presse Medicale*, October 14, 1936, and (together with the studies done in India in 1935) in *Bulletin du Centre Homeopathique de France*, February, 1937. This is the first English translation. In order to serve lay and medical readers alike, the general argument in the latter has been retained nearly in its entirety, the technical portions slightly compressed. The illustrations and their captions are, in any case, the data required. The more technical kind of medical term has been occasionally explained in parentheses.

A photograph is included, showing the face and form of the chief yogi who coöperated in Dr. Brosse's study. He is Sriman Krishnamacharya, who serves on the faculty of the Maharaja's Sanskrit College, Mysore, and is the author of a standard work on yoga, in the Kannada language. He and some of his pupils have also worked with Swami Kuvalayananda at the institution headed by the latter, at Lonavla, near Bombay. (This is the school of yoga wherein K. T. Behanan underwent discipline during his visit to India upon a Sterling Fellowship from Yale University). His Highness, the Maharaja of Mysore, Sri Krishnarajendra Wadiyar Maharaja IV, maintains the traditions of his grandfather, the third in the Wadiyar dynasty, in supporting systematic studies and exercises in yoga, the Mysore Government having issued in 1885 the standard treatise, *Hatha Yoga Pradipika*. It is customary for a certain number of young men of aristocratic standing to be trained in the elements of the art at the Jaganmohan Palace, a special official (at present Sardar M. Gopal Raj Urs) being designated to supervise their studies along with Mr. Krishnamacharya. From these details the Western reader will realise that yoga is, at least in its simpler forms, a generally recognised part of good indigenous culture in India in those centers where crass European positivism has not completely destroyed inherited values. From such centers this older knowledge of psychology can be expected to radiate.

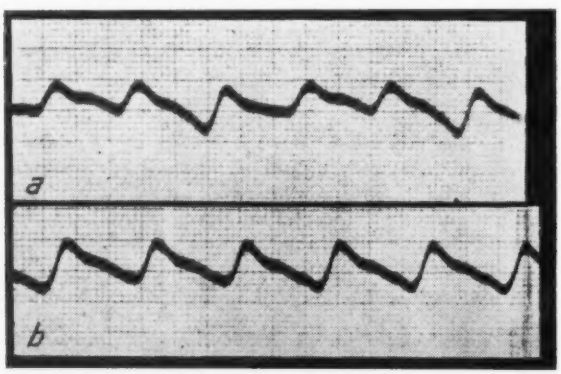
2. Even in the absence of arrhythmia the two kinds of psychic reaction brought about different arterial results: (a) *Concentration* of thought induced an hypertonic type of arterial reaction, with an accentuation of the detail of the systolic and diastolic waves. (Pl. 5) A like result is caused by the immersion of the arm in cold water. (b) *Diffusion* of emotion, on the contrary was accompanied by a reaction of hypotonic type, with curves indefinite and spread out (Pl. 6), such as is caused by the immersion of the arm in warm water. This last reaction is also obtained by arterial fatigue following long major compressions of the artery; the same reaction is again recorded, but contra-laterally, when the fatigue of a weight to be supported is imposed upon the segment of arm on the opposite side.

3. Finally, rare subjects could at will modify the rhythm of the pulse directly, either by slowing or acceleration.

The result of these experiments confirmed therefore that disturbed emotions cause physiological disorders and that, on the other hand, conscious control by the patient has a beneficient action on the autonomic system. From this it would seem to follow that one could re-educate the patient by asking him to live more constantly in this state of psychic discipline whose corollary is the regularization of the vegetative functions.

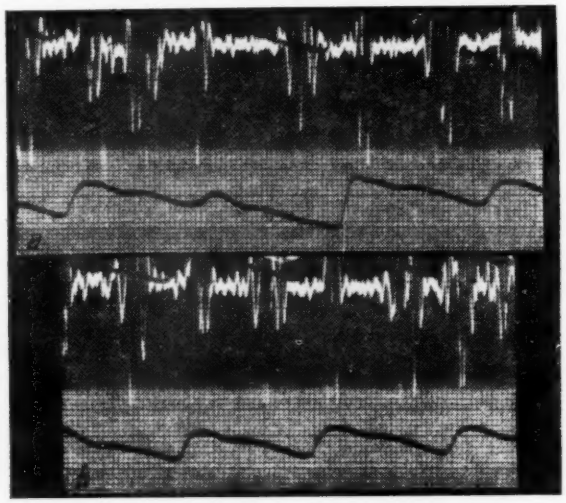


I Subject: 17 years old. The tracing represents the two curves, one above the other, of the pulse (below) and the breathing: (a) During a period of mental diffusion: respiratory arrhythmia. (b) During a period of concentration: regularization of the pulse.

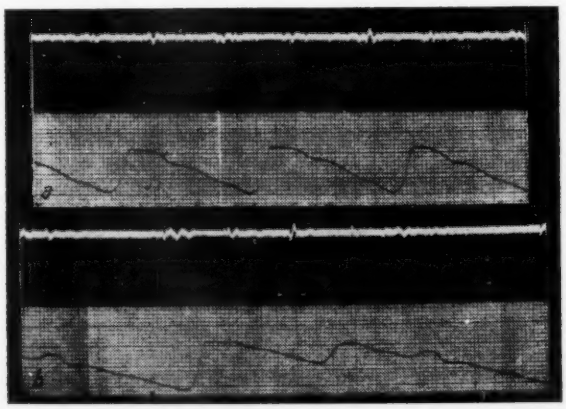


II Modification of a sinusal anisophygmia (inequality of the pulse either in volume, time, or force in the symmetrical arteries of the body) under the influence of mental concentration: (a) During a period of mental diffusion (immediately before the test): irregularity. (b) During a period of concentration (during the test): regularization.

These clinical findings were not alone confirmed by experimental tests, but were also justified by what we know of the encephalon and its nervous channels, according to the most recent data of anatomy. It has been established that there exist in the brain three differentiated levels of psycho-physiological activities: the cortex area of intellection; the midbrain containing the centers of emotions, in close connection with the hypophysis (the glandular organ situated at the base of the cranium); the medullary zone, or lower center of automatic vegetative life. Upon the inter-communications of these different areas recent discoveries bring us most important documentation due to the discovery of centers and fibers of the sympathetic system far beyond the lower stage and infiltrating in the zones from which it at first was believed to be completely independent. A number of sympathetic ganglia in the diencephalon explain the repercussions of emotions on physiological

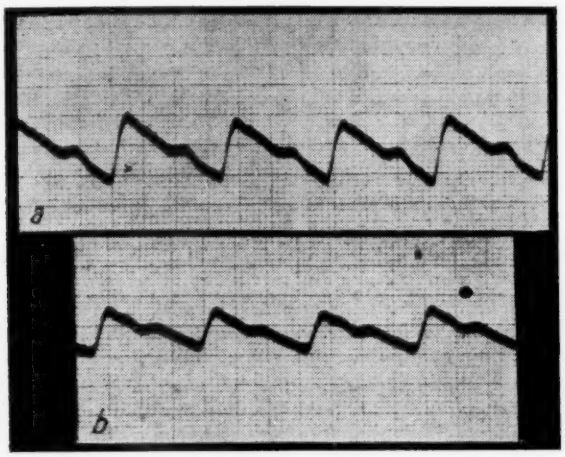


III (a) Extra-systoles during a period of mental diffusion. (b) Regularization during concentration. A phonocardiogram» (graphic record of heart sound) recorded simultaneously is added above to each of the tracings.

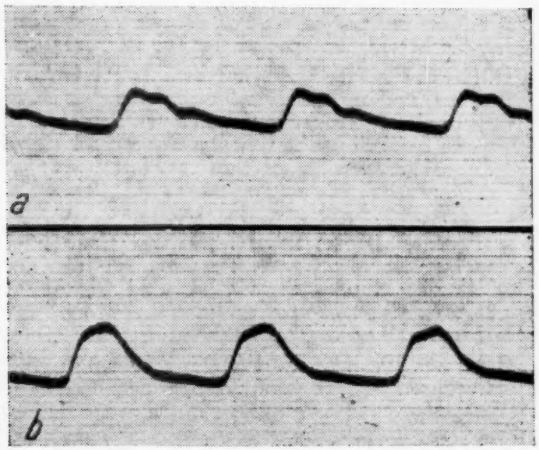


IV Tracing of a patient having reacted to the emotional test: (a) Regular pulse before the test. (b) extra-systoles in the course of the emotion. A phonoarteriogram (humeral) recorded simultaneously is annexed (above) to each of the tracings.

life, and fibers within the cortex account for the checking and regulating action of the cortex in vegetative phenomena. Thus the autonomic nervous system is not completely independent of the cerebro-spinal nervous system, but on the contrary, insures the interaction of all these zones of psycho-physiological activity which can be classified into a hierarchy, but cannot be isolated one from the other in the sum total of human life.



V Modifications of the arterial wave under the influence of concentration, excluding all arrhythmia: (a) Before the concentration. (b) During the concentration: decrease in height of the pulsatile wave, which keeps the clearness of its contours. (Reaction of a hypertonic type).



VI Modification of the arterial wave under the influence of the emotion, excluding all arrhythmia: (a) Before the emotion. (b) During the emotional state: increase in the height of the pulsatile wave, which loses the clearness of its contours. (Reaction of a hypotonic type).

VII Instantaneous modifications of rhythm in both directions under the influence of will, with a normal subject.

But as no one among us can escape interaction, what was then important was to be able to regulate it by determining the modality of these interactions and the law presiding over the totality of human activities. Already the clinical findings showed that:

1. In a state of mental concentration, the vegetative system governs its own functions correctly.

2. In a state of emotional excitement it is subject to functional disturbances.

3. A conscious effort of thought at an appropriate level can control temporarily the subconscious functions and place them to a certain extent under the control of the will.

It seems, therefore, that the factors "concentration" or "diffusion" of consciousness are revealed as regulator in the first case, perturbator in the second case, of the psycho-physiological complex, and are the very center of the "function." These two modalities of consciousness, one active, the other passive, are what we must try to define and place within the frame of our knowledge of practical psychology.

"Diffusion" is the passive state of consciousness which displays no effort to apply itself to a given object. This absence of direction gives free course to the play of associations of emotional or mental images succeeding each other mechanically. And one can see that in these conditions the notion of epiphenomenal consciousness naturally arises, since it simply witnesses the display of successive states, when, without obstacle, there unrolls that whole gamut of conditioned reflexes by which the whole psychic activity of man has been tentatively explained. The interference of the different levels(dark thoughts, violent emotions, psychological disorders) appear in a disastrous pathological aspect, reinforcing each other in a series of vicious circles, while consciousness, perceiving these phenomena and complacently identifying itself with them, neglects to exercise its own positive authority which alone could be beneficent.

In the active state of "concentration," on the contrary, consciousness applies itself in full freedom and with clarity upon a subject or a chosen object, by mastering the energies of the different levels which it drains towards its center of interest. Ceasing to identify itself with organs which it now utilizes, and acting as a dynamic tensor, the master of the function which it organizes, it is free to exercise upon all the points on which it applies itself an objective judgment. Applied to a mental exercise, it annexes the emotion as a focus of interest directed to the study at hand. Applied to the emotion, it annexes knowledge to give it an artistic expression which embodies the mastered emotion. Even applied at the level of physiological phenomena, it seems to be able to intervene temporarily to allay or relieve normally automatic subconscious functions and place them once more under the control of conscious will. Thus one could say:

1. Wherever consciousness is concentrated, it is free in its expression and masters its means.

2. When it is occupied at higher levels, the rhythm in the lower physiological level follows automatically, as a ball suspended at the end of a thread tied to a higher point accomplishes a rhythmical and regular movement.

Such is the psychological concept to which we were brought by our first researches, conducted upon about fifty subjects.

Yet, our experiments were not pushed far enough to justify these general hypotheses fully. In fact, while the pulse signs proved to be easily modified in the course of our tests, the electrocardiogram expressing a more complex and profound biological phenomena did not appear, under the same conditions, susceptible of modifications, and the freedom of consciousness at the physiological level appeared to us insufficiently demonstrated.

Now, in the West there are no subjects specially trained for the intervention of will in organic functions which could permit us to record more important results. On the other hand, no teaching with us systematizes such a habit nor transmits such an education; no tradition frames it into a general law. In the Orient, on the contrary, and in India in particular, century-old schools of yoga strive to train their subjects in a physiological control unusual to us — and that precisely by exercises of concentration upon functional levels classified according to a traditional psychological structure. No system, therefore, could be more interesting to know and examine thoroughly, on the spot, in its theory and its results than this system of yoga. It was with this goal in mind that we undertook an expedition, hoping to confirm and extend the findings of previous researches.

The major difficulty, outside of the transportation of apparatus such as the electrocardiogram, consisted in the almost absolute impossibility of being able to enter into connections in India with authentic yogis and not with charlatans. In order to reduce to a minimum the probabilities of failure, I appealed to officials of the Theosophical Society, which at that time was holding a world convention at Madras, for assistance in contacting real Hindu society. When the Minister of Public Instruction in Paris saw the written promise of aid from this organization so close to the indigenous culture and philosophy of India, he was reassured and made it possible for me to undertake this mission and pursue my research work in India. Thus I gained the confidence of the Hindu authorities and the sympathy of the yogis. The fact that I knew some Sanskrit and was familiar with oriental psychology also helped in making these contacts. It is the tradition in Indian States, especially in the Hindu States of Mysore and Baroda, that the Maharajas have a concern in these matters, and it was the benevolent interest Their Highnesses showed in our work which made it possible to make numerous and successful recordings. Later I was able to verify the wisdom of having chosen this method of approach, for in Benares I tried to contact a yogi, on my own, and this proved to be the only complete failure.

Before entering into the details of some of these recordings, it is necessary to clarify the subject, and to explain what yoga is from the point of view of the most eminent ascetics and psychologists of Hindu tradition. We expound their attitude in the following paragraphs.

Yoga is not, contrary to what is often believed in the West, either a philosophy or a religion (although it has religious inspiration), but a practical technique having as its goal the spiritual self-education of man. And while it is not intended for the cure of morbid states (this role belonging in traditional India to ayurvedic medicine), it includes an education in physical health indispensable as a basis of this discipline, and a training in voluntary mastership of functions habitually automatic. This does not depend in the Orient on any written treatise on psychology, just as one does not study anatomy in a treatise on gymnastics. But in the same way as a bodily motion always implies an organic structure, the spiritual exercise of yoga implies a psychological system whose organization it uses. This system is seen in the darsanas (insight) as a whole. It recognizes in man (who, in his pure essence, is spiritual energy itself) a series of levels in classified orders, physiological and psychological, which are forms through which he, who is life, is obliged to express himself, but with which levels he must not confuse himself. He must, on the contrary, master them by using them and, on the scale of these levels, progressively raise his consciousness to the end of realizing union with the transcendant. Yoga literally means union. In terms of yoga, *function* can be defined as the use made by life, that is to say, consciousness, of one of these levels where it concentrates itself. Moreover, let us say in passing that man is considered consubstantial with his natural milieu, and that a physical universe corresponds to the human body, a psychic universe to psychic man, and a spiritual universe to spiritual man. To master an inner human level is to acquire at the same time this mastery on the same world level, and yoga aims at the ultimate acquisition of a progressive and total mastery of all universal forces.

The specific exercise of yoga, the one which permits it to be reduced to a unique technique, whichever may be the secondary exercise, is "mental concentration" (*samyama*). It is a concentration pushed beyond anything we can imagine, and divided into three periods:

In the first period (*dharana*), the attention is fixed upon a chosen object (a body organ, a feeling, a philosophical concept, etc.), It is a struggle against automatic mechanisms which have a tendency to make it deviate by the involuntary presentation of other objects. It has to return upon this object and maintain itself upon it for a period of time determined by the will. It is the concentration of diffused attention and a focussing upon a single point. It is therefore the mastery of the essential function of the I: attention. The attention can have a different object at different times, but the mechanism of its mastery remains identical. The elements making up this first period are therefore triple: subject, object, and act of concentration.

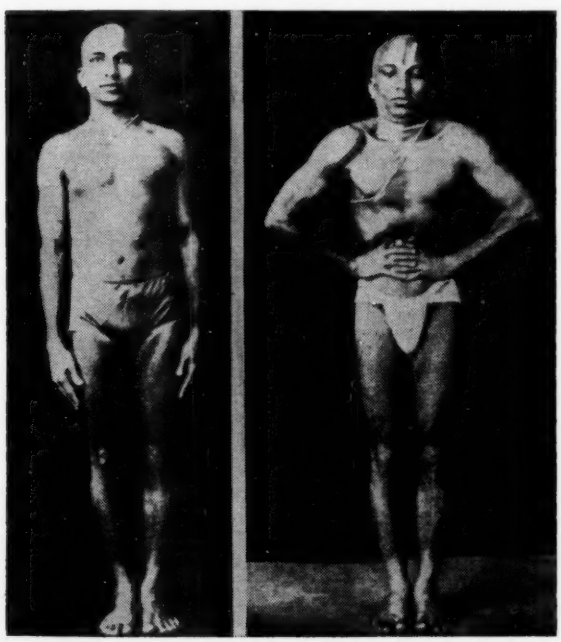
In the second period (*dhyana*) consciousness loses awareness of effort and the inhibition of the unconscious processes is complete. The *I* has only before it the chosen object upon which concentration, now happy and easy, can last indefinitely. There is now only the duality of subject-object, the feeling of effort has disappeared.

In the third period (*samadhi*) this feeling of duality of subject-object in turn disappears. The conscious being is indissolubly united to the object of its contemplation, melts into it and becomes identical with it.

These three periods constitute for the expert in this art a unique exercise. But the third is the most important; without it it is useless to speak of yoga. Yoga is *samadhi.*

One can see that in spite of this unique technique, there can exist several orders of yoga which are a function of the level used. The yoga exercised upon the psychological functions is raised in dignity above the art when exercised on the physiological functions, and is called royal yoga (*raja yoga*), subdivided into three categories: intelligence, feeling and active will. Physiological yoga, in which we are more particularly interested in its recordable results, can be only the initial stage of higher yoga. It has been called the yoga of effort (*hatha yoga*). For about the last fifty years it has become very common in India, and is about to spread also in the West, where the mystical aim general to yoga is neglected and the ambition is restricted to functional hygiene.

From these varieties of yoga reputedly flow an infinity of diverse powers, according to the object of concentration. These powers are, says the yogi, a function of the state of *samadhi* and inherent to it. Union in fact gives knowledge and knowledge confers power. For example, it is said that a yogi in absolute state of union with light would not be fully observable; with the power of sight he could create collective hallucinations; with sympathy tame ferocious beasts. In India there is no lack of wide-spread belief in matters of this kind. But, most often, these powers are of no interest to the true yogi, who has a repugnance for these demonstrations and pursues the elevation of his consciousness to the higher levels. The variable goal which can be aimed at by the yogi explains the divergence of opinions concerning them — divergences depending upon the levels at which they find satisfaction, upon the quality of the powers they obtain, and the use they make of them. And one can conceive the enormous difference separating a simple trickster and a holy personage, retired from the world and consulted from afar upon the most highly spiritual problems.



VIII Professor of Yoga from the school of Mysore, in repose, and in one posture.

In order to cope with the exigencies of the experiments and the category of our instruments, we had to enter in contact with yogis giving physiological manifestations, particularly circulatory ones, and at the same time honest yogis, the single experience undertaken with an exploiter having proven, as said before, scientifically void of results. The difficulties of approach from the intellectual and religious sides were conquered by awakening in them a sympathy for our work and thereby inducing an active collaboration. Lending themselves to the annoyance inherent in our recordings with absolute calm and confidence, they even showed a touching gratitude for the interest given their effort. The *hatha* yogis whom we studied were sometimes professionals using their exercises for therapeutic ends, and teachers of physical culture in special schools. Sometimes they were amateurs practicing yoga only as the highest hygiene giving them a perfect physical and moral equilibrium. Finally, for some of them, *hatha* yoga was only a training for higher yoga, but these too lent themselves to our experiments with extreme good grace.

Outside of the yoga exercise itself, described at length as mental concentration, a certain number of preparatory conditions are demanded of the yogi. A special diet has been devised, in which all the portions are carefully balanced so as to create the least possible waste and eliminate, as far as possible, all toxic elements. The general hygiene also comprises self-imposed disciplines of silence, sometimes very prolonged; the regimen of psychic hygiene includes serenity, study, the absence of passions. Physical culture is practised under the form of postures which may appear to us as contortions but which, on the contrary, are calculated to insure a permanent action on a function while the attention is concentrated upon it (Plate 10); these postures are so varied that they develop harmoniously the whole body, which remains at the same time supple and strong.

Finally, and above all, is the mastery of breathing, and through it, the yogis claim, mastery of vital energy (*prana*). This science of breath control (*pranayama*) is for them primary, and is the object of an extremely elaborate technique having for a basis apnoea, suspension of breath, either with full or empty lungs. This art is not simply an exercise performed on the material plane by the *hatha* yogi. Physical breathing, which binds us laterally to physical environment, is the symbol of another "breathing", spirit* breathed out vertically, as it were, by the divine into matter and breathed in again towards it. This rhythm constitutes evolution. Thus physical *pranayama* is only the replica of spiritual *pranayama*. For the *raja* yogi breathing out is to go out in the world, to act in it, and to conquer it; to breathe in is to have the certainty of being spirit; to

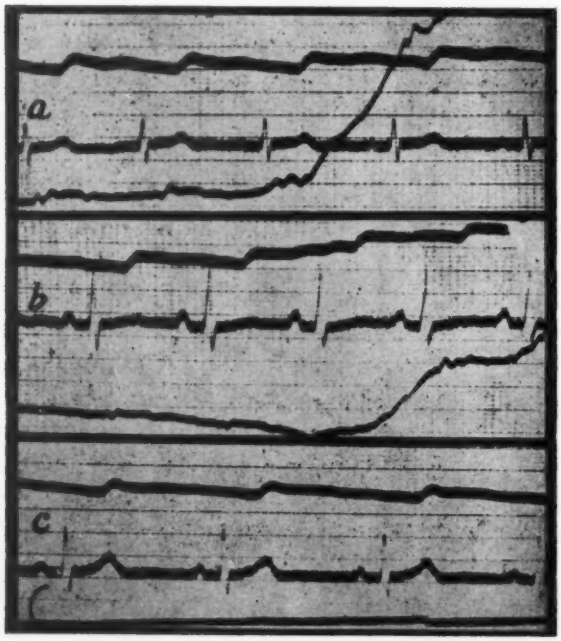
* The term *spiritus*, breath, is prevalent in Western thought as applied to the source of evolution (creation), and the notion of a return to the source is familiar, although the Western view is formal and even unnatural, and the technique for self-mastery or self-return is wholly lacking. The idea of "salvation" takes its place. Ed.

hold one's breath is to affirm the union in oneself of conquering spirit and mastered matter. Higher *prana-yama* is also mastery of breath, but here *prana* is divine breath, whose expression we are by its descent into matter, and it is for us to evolve that spiritual breath and thus return to the divine source.

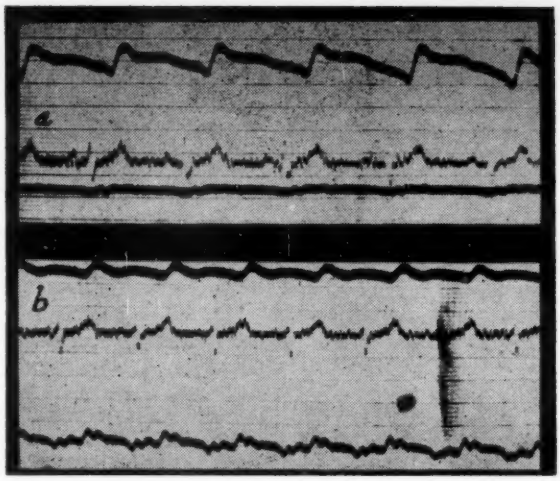
The atmosphere is thus the vehicle of cosmic vitality which is, as in man, spiritual energy. The philosophy implies that there exists a lateral *prana* (vital air) as well as a vertical *prana* (spiritual creation). The ignorant man thinks that the psycho-spiritual air "breathed in" by the brain is distinct from the air breathed in through the body. By uniting this double technique, one physiological and one of mental concentration, yoga reduces this duality to unity and makes concrete by experiment this truth that we are the divine life, one in man and in the universe.

The foregoing, in brief, is the Indian philosophy of the subject.

In the physiological domain, this mastery of breathing considered as a preparatory yoga exercise by the yogi, is objective and can be definitely recorded. After years of training, phases of apnoea (suspension of breath) can last several hours: the longer the suspension of breathing, the greater the mastery of yoga. One of our yogis, as an experiment, had himself buried for ten hours under the observation of the medical corps of Baroda, who noted a tachycardia (rapid pulse) of 160, which quickly returned to normal. In the course of our examinations, the pneumograph registered repeatedly for ten to fifteen minutes these phases of apnoea so superficial that



IX Modifications of the waves P and T of the electrocardiogram during the same exercise (Derivation [lead] II): (a) Flattening of P with low voltage, in the first period. (b) A minute later, accentuation of P, flattening of T and increase of the voltage for the rapid waves. (c) At the end of the exercise during the "control of the heart", normal aspect of the electrocardiogram.



X (a) and (b) In the course of this exercise, during which the electrocardiogram shows a little general muscular tension, notice, on the one hand in the rapid waves the dimunition of R and the accentuation of S. On the other hand note the exaggeration of the shock of the apex on the line of the pneumograph which remains horizontal in apnoea. On (b) this exaggeration coincides with a considerable reduction of the arterial pulsatile wave.

it was accompanied by no expansion of the thorax. By withdrawing what he calls vital energy, the yogi thus puts his body in a state of slowed-up life, comparable to that of hibernating animals. We were able to show this clearly through research of basic metabolism with the small Morisse apparatus. If the absolute figures should be erroneous under these difficult conditions, at least the comparative examinations before and after yoga exercises had some value, as the period of neutralization of an alkaline solution by the outbreathed carbonic acid was always longer by two or three minutes after the experiment.

Before we go on to describe the circulatory findings, which were the object of our graphic recordings, we may mention a few physiological feats witnessed by us. The mastery of the yogi over his voluntary muscular system is such as to permit already such difficult postures, for example, a lateral displacement of the long straight muscles of the abdomen, contracted; the result is abdominal massage. But this elective mastery is also extended to the smooth fibers, regulating at will the peristaltic and anti-peristaltic motions, permitting in both directions the play of the anal or vesical sphincters and insuring by simple suction and without the help of any other instrument the penetration of liquids in the bladder or the rectum.

Specifically, in our instrumental cardio-vascular examinations, we were able to record on the photosensitive paper of Boulitte's electrocardiograph 300 meters of film presenting three superposed curves: the arterial pulse, thanks to Pachon-Boulitte's capsule and Pachon's pneumatic cuff; the electrocardiogram; finally, the respiratory curve recorded by Marey's pneumograph. Moreover, the latter's diaphragm placed exactly on the region of the apex of the heart enabled us to read on this last curve the modalities of the shock of the apex.

Our recordings were made during yoga exercises, including simultaneously the respiratory exercises (particularly the long phases of apnoea) and mental concentration pushed to the degree of *samadhi*. Sometimes there were usual and progressive yoga exercises; at other times, upon our request, there were special exercises which the yogis held would have specific influence upon circulation.

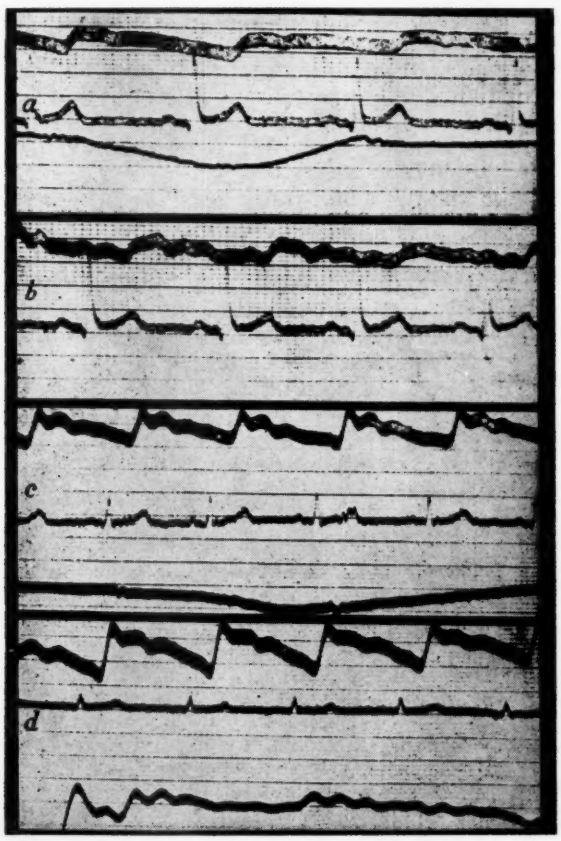
In the analysis of the results given by these tracings we will no longer refer to the modifications of the respiratory rhythm, which modifications show a prodigious accommodation to conditions of anoxemia (failure of the blood to oxygenate) which, in most of us, should cause asphyxiation. We will also mention, in passing, the changes of rhythm causing differences from 55 to 150 pulsations a minute, and the variations of amplitude and character of the pulse which reproduce on the graphs, the modifications already noted in the West but shown here in a much clearer way (Pl. 11, a, b). The modifications in the shock of the apex can also be seen (Pl. 10, a, b), also certain paradoxical relations in the intensity of the different curves: arterial, cardiac, electric, in the course of the same exercise (Pl. 11, d; Pl. 12, b). But the most important phenomena, precisely those we had justifiably come to India hoping to trace accurately, were shown by the electrocardiogram. By reason of the objectivity of the apparatus and the invariableness of consequence for a given exercise, the results are extremely curious and interesting. The modifications affect the different waves, auricular as well as ventricular, either in their very existence, or in their height, or in the reciprocal relations, and that at an interval of a few minutes or a few seconds on the same tracing. Several times in succession we checked the millivolt, so as not to make gross errors in our measurements. Thus follow, in succession on the same curve;

—Absence of P with complexes QRS and T normal;

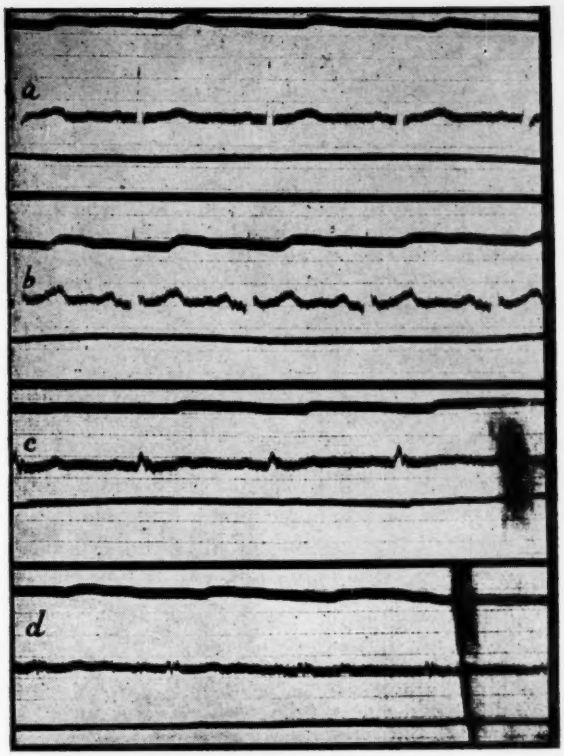
—Flattening of T with appearance of P;

—Finally, normal aspect of the three groups, when the yogi announces the control of the heart (Pl. 11).

In other cases the progressive suppression of R and the accentuation of S (Pl. 10) in the course of the same derivation [lead] can be noted. More frequently it is a low generalized voltage (Pl. 11, d, and 14, c, d). In the most marked cases, after a phase of angling and widening of the ventricular complex, it ends by a flattening, then a disappearing of all the waves. The only thing that can be seen now on the iso-electric line is a tremor of lowest rank, the only trace of cardiac contraction, which it is almost impossible to detect (Pl.



XI (a) and (b) Accentuation of the arterial waves under the influence of mental concentration (before and after). (c) and (d) With another subject, also clearness of detail of the pulsatile wave. On the other hand, low voltage during the exercise (d) coinciding with the increase of the height of the arterial pulsation.



XII (a) At the beginning of the exercise, normal electrocardiogram. (Derivation [lead] I.) Breathing extremely superficial. (b) A few seconds later: accentuation of all the waves of the electrocardiogram and of the image of the pulse. (c) Two minutes later: low voltage induced in all the waves. (d) Towards the tenth minute of the examination: still greater reduction of the voltage during total apnoea. At the end of the exercise, the image was again the same as on (a).

12, d). One would, upon seeing this curve, normally give a very severe prognosis, but in the preceding and following moments the electric silhouette was not only normal, but even exaggerated in its voltage, under the will of the yogi (Pl. 12).

Before these facts it does not matter much whether our hypotheses attribute them either to an abnormal concentration of carbon dioxide in the blood, or to a change in the axis of the heart, or to a modification of the ionization of the tissues, or to these combined mechanisms or unsuspected other mechanisms, since the present state of our knowledge does not permit us as yet to take a stand. Whatever be the mechanism, what remains rightly dumbfounding is that the extreme fall of voltage takes place precisely when the yogi announces that he is going to withdraw the vital energy from his heart, and that the return to a normal or even an exaggerated voltage takes place when he declares that he controls the correct functioning of his heart. Now the yogi thinks of vital energy (*prana*) as electric energy. That is, he claims it to be of the same nature as lightning. On the other hand it is by the knowledge of a special science of breath that he can regulate vital energy. Recently much research has been done on the role of the lung in influencing the electric charge in the blood, the alveoli of the lungs drawing from the breathed-in air the negative ions which would give their charge to the colloids.

Thus we find these yogis are masters over divers human activities. Knowing nothing about the structure of their organs, they are however the incontestable masters of appropriate functions. Moreover, they enjoy a magnificent state of health which they could not keep if they continually violated the laws of physiological activity in the course of their extraordinary and prolonged exercises. And the results confirm the theory upon which these exercises are based.

Should these results not encourage us to pursue patiently these verifications in the vast experimental field at our disposal, by not hesitating to use such instruments, for example, as the encephalographs which could furnish a documentation of the highest interest in the field of concentration? Restricted as they may be, these experiments confirm for us the law we wanted to verify at the physiological level, namely the superior power of consciousness wherever it is concentrated. The modification of a biological phenomenon as complex and intimate as the electrocardiogram registers constitutes an important testimony.

On the other hand, these results, as well as the general study of yoga, allow us to confirm an idea of "function" in the sense in which we were able to conceive it before these verifications. When Westerners declare that "function creates the organ", our thought includes however many restrictions to this marvelous axiom, and we have a tendency to consider that function is simply the state of activity of living matter and that physiology depends on anatomy. On the contrary, when the science of yoga also states that "function transcends the organ", it builds upon this assertion a vast system of practical verifications and shows effectively the subordination of the organ to the function. And that should induce us to consider physiology more and more as the domain not of simple lateral interferences from organ to organ, but as a complex functional hierarchy also in the "vertical" sense (if one can say so), the psychic organism (emotional and mental) continually intervening to regulate or disrupt physiological life, according to the use put to it by conscious autonomy. It is the latter which gives a human character to the activity of psycho-physiological levels in man. But if we give up conscious concentration and permit the loss of our autonomy on the psychic levels, the latter will, in turn, cause trouble to the physiological activity. The physiological function is bound to the psychic function and the latter is attached to the I. Man includes therefore indispensably a responsible conscious I, and general health requires necessarily its autonomy.

From the therapeutic point of view, it is not a question of sending our Western patients to pursue an extended self-mastery which is opposed to the very nature of European life. But these findings give us a direction suggested by our first investigations. When a physician undertakes and directs the cure of a functional syndrome, besides physical medication he can help to give confidence to his patient. But he could do more, and also show the way towards re-education by conscious control. Contemporary psychology has established by tests the relationship between consciousness and the psychological functional levels. It tends to orient education towards a culture of conscious autonomy nearer to the tradition of yoga than our traditional introspective psychology did, and also our total educational practice based on the latter.

BIBLIOGRAPHY

LAUBRY, C. : Sémiologie cardio-vasculaire, 1 vol., Paris-Doin 1924.

LAUBRY, C. : Nouveau traité de pathologie interne, t. III, maladies du cœur et des vaisseaux, p. 695, 1 vol., Paris-Doin 1930.

MACKENZIE, J. : L'avenir de la médecine, p. 13, 1 vol., Paris-Alcan 1922.

WENCKEBACH, K. F. : Die unregelmässige Herztätigkeit und ihre klinische Bedeutung, Leipsig 1914.

WIERSMA Der Einfluss von Bewusteinzustanden. *Zeitschrift f. D. ges. Neurologie und Psychiatrie*, **19**, 1913.

REISSNER, O. : Ueber unregelmässige Herztätigkeit auf psychischer Grundlage. *Zeitschrift fur Klinische Medizin*, **53**, 1904.

METALNIKOV, S. : Facteurs biologiques et psychiques de l'immunité. *Presse Médicale*, **40**, 1932.

METALNIKOV, S. : Sur le rôle des réflexes conditionnels dans l'immunité. *Presse Médicale*, **42**, 1934.

SALMON, A. : Un centre végétatif épileptogène existe-t-il dans la région diencéphalique. *Presse Médicale*, **40**, 20, 1932.

SALMON, A. : Le rôle des noyaux diencéphaliques dans le mécanisme des crises èpileptiques. *Presse Médicale*, **43**, 405, 1935.

CARREL, A. : L'homme, cet inconnu, 1 vol., Paris-Plon, 1935.

BROSSE, T., LENEGRE, J., MAGE, J., et VAN BOGAERT, A. : Contribution à l'étude des réactions vasculaires au chaud et au froid. *Archives des Maladies du Coeur et des Vaisseaux* **28**, 635, 1935.

LAUBRY, C., et BROSSE, T. : Interférence de l'activité corticale sur le système végétatif neuro-vasculaire. *Presse médicale*, **43**, 1625, 1935.

CREATIVITY AS EDUCATION'S CORE

Oliver L. Reiser

The answer of educational and cultural atomism was given at Hiroshima. Now universities must help to find the principles of social synthesis. The problem of determining the answers to specific questions, *without reference to the broader social framework,* is no longer the concern of the departments within a university (of physics or chemistry, for example); such problems of detailed factual knowledge should be turned over to subsidized industrial or social research organizations (such as the Mellon Institute of Industrial Research). From now on the University must view its functions and contributions within the context of a developing world culture.

There are probably a number of concepts which could supply the polarizing principles to cohere the special activities of the several departments of a graduate school. But whatever concepts are selected, they must be rich and fertile in nature and cut across all fields of graduate study. It might be possible for universities to commit themselves to particular phases of a more inclusive type of inter-university integration program, but that would require a form of organization of research far more extensive than what would be contemplated by any university that is considering merely its own problems and needs. This broader pattern of integration would present problems for a National Science Foundation, especially if it included the social sciences within its purview, but not for any individual university.

As an example, and merely for illustrative purposes, we suggest the concept of *Creativity* as the focal organizing idea for a graduate study and research program. Here is something of the theory behind this proposal.

Many efforts have been made by many investigators to discover and define what they regard as the "basic law" of the universe. The significant thing about these efforts is the fact that these attempts are themselves examples of that basic law—the creative fabrication of the new out of the old. This factor of creativity has not yet come into its own as a subject of study. To be sure, the arts have nourished the concept of creativity as a means of self-expression, and we have come to recognize in some degree the creative power of science. (It was stated by one physicist that in creating the atomic bomb man has produced conditions which have never before existed anywhere in the universe.) And now Dr. H. N. Wiemann of the University of Chicago advances a plan for the integration of educational objectives by making the subject of creativity integral to a general university education. In line with this thought he proposes to treat creativity as the factor common to all religions on the ground that the core of every great religion is the concept of man as a creative being embodying ultimate values in society. Thus creativity might be agreed upon as a means of supplementing science education with the study of the spiritual nature of man as a creator.

The idea of creativity provides a meeting-place for the man of letters, the scientist, and the religious leader. Even the artist comes into focus here, for he is the creative interpreter who works directly on consciousness in preparing the way for the acceptance of new social techniques. (One thinks here of the left-wing element which has an inkling into the propaganda value of the arts.)

If—in this manner and for these reasons—we regard creativity as the law of evolution at work in the human mind, the function of education at all levels becomes that of teaching the creative way of living. A "creative morality" would then be "doing good" by creating—not by merely conforming to the established traditions of the past. When social ideals are reoriented to the fact of creativity in man, it becomes clear that a culture or social tradition that ceases to evolve is no longer responding to a fundamental need in human nature. Men live most freely when they live creatively, and the morality which ends up as charity, or aristocratic paternalism, or slavery to local customs is not a humanly creative morality.

What is here being proposed is this: Creativity as the focal concept of education is the tool whereby we undertake:

(1) The examination and evaluation of the body of tradition
(2) Selection from it of certain elements to be emphasized and transmitted
(3) Repudiation or discard of outworn elements
(4) The consequent continual revision or recreation of tradition.

This scheme—which is a part of Dr. Wiemann's proposed reform—elevates the natural creativity of man to a place of primary importance in the social scheme and places tradition and the other socially inherited elements of culture in the proper place as a constantly evolving body of useful concepts and practices. Then, instead of the innovator being regarded as subversive—until he is dead and perhaps famous—he will be accepted as the natural product of education. This means, as Dr. Wiemann recognizes, that creativity can exist only in a dynamic society, and a dynamic society can exist only where creativity is functioning.

But education conceived as recreation of tradition is not itself necessarily good. As Dr. Wiemann recognizes, education functioning as an agency over and above unquestioned and unexamined tradition, giving direction and coherence to society, could become an evil. Its valuations and selections might be wrong and the consequent revision of tradition might make life worse. If education is to promote social good, we must know what social good is. According to Dr. Wiemann, any social organization is good to the degree that the previously mentioned "fourfold creativity" can work with freedom within its own bounds and between it and other groups.

It is generally agreed among thinking people working for a good society that education is the key to the maintenance of a free, intelligent public opinion. But a free, universal education that will condition men so that they may realize both their rights and responsibilities cannot be attained until we clarify our minds on the functions and values of education.

The formulation of a theory of education has been complicated, and at the same time simplified, by the emergence in recent years of a powerful neo-Thomistic movement for the return of education to the traditional forms, thus restoring the power of authoritarian religion over educational methods and subjects. On the other side, progressive education has plunged from experiment to experiment, until its very exuberance produced conditions under which some persons were inclined to listen sympathetically to the neo-Thomistic concepts which urged a return to the more rigid disciplines, moral and mental, with a greater reliance upon the established and less experimental attitudes. The resultant tensions have brought all angles of the controversy into greater relief; they have also forced attention upon the basic problem of the place of religion in education, or education in religion, or both.

In the meantime there has been a gradual withdrawal of the older materialism or mechanism of science, due to the penetration of science into dimensions of nature and human experience which do not harmonize with the older conceptions of reality. Whereas scientific thinkers and those influenced by scientific directions were justified by the state of science some decades ago in declaring that the universe is a complicated mechanism, science today, on the basis of an expanding body of knowledge, seems justified in taking up a new position where the dimensions of advanced scientific thinking intersect the domains of metaphysical and religious thought.

One of the first fruits of this new position of science has been a resurgence of hope on the part of orthodox and authoritarian religion that its outworn theology can somehow or other be steamed and pressed into something resembling an up-to-date vestment for a religious revival.

Those who cherish this hope forget that science moves forward into the previously unknown, not backwards into the outworn. And they also forget that the practice of religion—any religion, Christian, Moslem, Buddhist, and so on—is today far from the sources of original inspiration and desperately in need of channels of creativity. Any institution which in the middle of the twentieth century has need of the trappings of the thirteenth century, or the seventeenth or nineteenth century, to justify its forms and activities is sorely in need of housecleaning, whether it be a religious, political, economic, or educational institution of a culture.

No small part of our confusion in this day on matters of religion is due to the difficulty we encounter in distinguishing between ecclesiasticism and religiosity. Many persons are inclined to deny themselves an interest in religion, when what they actually mean is that they have no faith in dogmatic theology or the institutionalized forms of particular religions and organized priesthoods. Even earnest and honest churchmen make the same mistake and seem to feel that any attempt to tinker with the forms of their religious institutions is likely to "destroy religion," failing to realize that the religious spirit is timeless and formless, and that the particular forms of sectionalized religion are incarnations that must change, or be replaced, as the religious spirit in man expands with his increased awareness. Very often in the troubled effort to protect the *forms* of religion from change, the spirit itself escapes and incarnates in some form which orthodox religion will not recognize as religious.

Yet, there is a religious spirit, there are common forms to all religious experience, there may be a body of principles relating to the development of religious awareness, and if these factors could be extracted and examined, a great many people who now regard themselves as indifferent to religion, or as anti-religious, would realize that because of their genuine religiosity they have merely renounced the outworn forms of religious sectarianism and gone in search of a more universal expression of religious principles.

The breach between scientific thought and authoritarian religion resulted in a standing cleavage between the teaching of science and the humanities, and the teaching of religion. Religious institutions avoided, as long as they could, the teachings of science, while modern universities avoided the teaching of religion. This rivalry still persists. Nowhere has the struggle between the elements of the existing antagonisms been greater than in the University of Chicago, and perhaps it is for that very reason that from that center there emerges a plan which seems to promise a new outlook which could give social direction in this time of transition and reorganization. The plan would provide a "competent education which will direct men to a good so great and so accessible to all, that powerful disruptive interests cannot seduce them."

In a paper delivered before the Conference on Science, Philosophy and Religion, in New York in September 1944, Dr. Wiemann presented his ideas on teaching creativity as the common factor in all religious life. Dr. Wiemann's attitude is that the exclusion of any study of the spiritual life of man from education has left a gap which has not been filled, and a need exists for some understanding of what is widely held to be the source of good. He maintains, however, that no religion can be integrated into a general scientific education because each religion in our western tradition is rooted in the concept of a "reality which is super-temporal, super-spatial, super-material-social-historical." Each religion has its own special interpretations of that reality. These interpretations cannot be submitted to the research techniques of the scientific method in university courses, and if integrated with a general course would have to be accepted on traditional grounds without investigation.

Dr. Wiemann's solution is to teach creativity as the factor common to all religions. Theological schools could teach their own versions of the approach to creativity, but if this concept were introduced into general education as the means whereby the spiritual nature of man could be discussed, it would provide a place for a common religious factor, yet keep the churches out of the humanities and the social studies.

It is impossible to do more than merely sketch Dr. Wiemann's idea here. But he would implant in education a working knowledge of the "creative source of good," in such a way that it will not be confused with any "created good" such as is achieved in any community, or ideal of goodness, truth or beauty. The student will learn to regard "all created goods subject to the transformative demands of creativity." Defining creativity as the "value-making reality," Dr. Wiemann would show "how this creativity is related to the symbols of religious faith and to the ultimate realities proclaimed in the great religious traditions which our culture inherits." But this creativity would not be taught as identical with the "ultimate reality" of the religious faiths. These great religions, he writes, "assert that this ultimate reality does work in time, space, matter and history, to create all that is good and to direct the world towards what is better when men meet the required conditions. Here is where creativity can be related to the great faiths." Wherever ultimate values are manifested in this world they are the fruits of human creativity, and consequently the study of creativity as the highest form of human action is a simple but startling solution for the great problem of relating religion to education for life.

The implications in this proposal are great in their revolutionary possibilities. Admitting creativity to be the fruit of the religious life would be so marked a change in orientation that every religious organization would, by accepting this thesis, be forced to alter a great part of its attitude. Religion would be required to change over from the role of the preserver of the status quo to that of the innovator. Yet this is actually the function of religion in its original inspiration. That is why we find in so many revolutionary movements, social, political, economic, educational, literary, or otherwise, a religious fervor embodied in the enthusiasm of its exponents. The vision that lies at the heart of any great new movement is pentacostal in its effects, for vision is never of what is traditional and obsolete, but always of something as yet uncreated and seeking manifestation. The practice of religion should induce that vision. The great value of Dr. Wiemann's plan is that it would teach creativity as a universal technique for the translation of vision into applied activity.

The several faiths which cannot agree on their transcendant levels might agree to accept this creativity as in some way related to the transcendant; they could unite at a point where education could join them in one of the most crucial responsibilities of the time. This task is nothing less than giving direction and order to society and human life by criticizing and evaluating the traditions which heretofore in great part have worked automatically. This criticism and evaluation has become the most imperative demand of our time. Education and religion are the only agencies that can do this effectively; but they cannot do it if they work at cross-purposes. As Dr. Wiemann says:

"Human desire today is equipped with the mighty power of modern science and industry, yet uninstructed concerning the source and path of value. At the same time, the automatic sanctions of unquestioned tradition are losing their grip. Under such conditions human desire will spread havoc unless education and religion unite and give guidance if we are to escape tyranny and other great evils. But education and religion cannot unite nor can education alone take this responsibility unless there is some agreement on what is value and this agreement approximates truth."

MAJOR BIOLOGICAL PRINCIPLES

W. E. Martin

In *Science Education*, Vol. 29, Nos. 1 to 3, 1945, W. Edgar Martin reported a survey of biological principles important for general education. We reprint, with kind permission of author and publisher, an instalment of the hundred major principles graded in order of decreasing value as determined in three separate evaluations. (To be concluded)

1. The food requirements of every living thing are: materials for growth and for replacement for the fuels capable of yielding, when oxidized, the supply of energy without which life cannot continue; that provides for the continuance of life on the earth by providing new individuals.
2. The cell is the unit of structure and function in all organisms.
3. The protoplasm of a cell carries on continuously bathing fluid of cells.
4. Reproduction is a fundamental biological process upbuilding of protoplasm (anabolism) and the processes concerned with the breaking down of protoplasm and elimination of wastes from the cell (catabolism). The sum of all these chemical slight wearing away of the living tissue involved and physical processes is metabolism.
5. Circulation is carried on in all living organisms. With increase in size and complexity of the body of an organism there goes a corresponding elaboration of the transportation (circulatory) system.
6. All living organisms (except viruses and bacteriophage) carry on the common life processes; reproduction, growth, nutrition, excretion, respiration and irritability.
   in any activity; minerals, the necessary constituents of cell structures, of cell products, and of the processes concerned in the growth and repair or all the general processes of any living body; the
7. In the presence of sunlight the chloroplasts of chlorophyll-bearing plants convert carbon dioxide and water into intermediate substances and these into sugar, and that into starch, and liberate oxygen; this directly or indirectly producing practically all the food in the world.

8. A balance in nature is maintained through interrelations of plants and animals with each other and with their physical environment.
9. Cellular respiration (aerobic decomposition) occurs in all living cells and all organisms possess structures by means of which it can be carried on. Its first step is intake of oxygen either directly from the air or dissolved in water, its final product is carbon dioxide, and free energy is released. In the cells it is accomplished at ordinary temperatures by the intervention of special enzymes.
10. Cells are organized into tissues, tissues into organs and organs into systems, the better to carry on the functions of complex organisms.
11. In organisms the end products of metabolism, water, carbon dioxide, and nitrogenous compounds, are either stored in the cells as insoluble crystals, are eliminated in solution by diffusion, or osmosis (excretion); are incorporated into useful cell products (secretion); or are recombined into food substances within the organism.
12. Most cases of fermentation, souring and putrefaction are brought about by living micro-organisms.
13. Food, oxygen, certain optimal conditions of temperature, moisture, and light, are essential to the life of most living things.
14. All the higher forms of terrestrial life are dependent either directly or indirectly on the soil bacteria for their nitrogen supply.
15. In sexual reproduction a male cell from one parent unites with a female cell from the other parent to produce the young (except in the few cases of self-fertilization).
16. All communicable diseases are caused by microorganisms.
17. Protoplasm is the physical basis of all life.
18. The multitude of interrelated neurons of the nervous system of higher animals form a complex system through which every organ of the body is in connection with every other organ.
19. Living things alter their types; present species have not always existed, but have originated by descent from others which in turn were derived from still earlier ones, and so down to the first living forms.
20. All living things respond to stimuli in their environment.
21. The biological functions of color are to conceal, to disguise, or to advertise.
22. A parasitic organism harms its host in various ways and to various degrees, by actively attacking the tissues, by shedding poisons (toxins) which are distributed throughout the body of the host, by competing with the host for food or even by making reproduction of the host impossible.
23. All living things are slowly changing, both structurally and functionally, in response to changes in their physical environment.
24. Every species of organism is subject to certain checks or controls in the form of enemies and only those members that are most capable of avoiding their enemies survive to reproduce new offspring and thereby transmit many of their characters to their offspring.
25. Protective adaptations aid survival.
26. Digestion in plants and animals is carried on by enzymes, or organic catalysts, which are made by the organisms themselves and which take part in and speed up the chemical reactions but do not undergo any permanent chemical change themselves.
27. Enzymes, vitamins, and hormones are chemical regulators (stimulators and suppressors) of the reactions that occur in living organisms.
28. Living things come only from living things.
29. All plants and animals are engaged in a constant struggle for energy.
30. The energy which makes possible the activity of most living things comes at first from the sun and is secured by the organism through the oxidation of food within its body.
31. Regeneration is almost universal among living things; from the simple to the more complex animals the abilities to regenerate lost parts and to reproduce asexually fall off, gradually and independently, as the body becomes more specialized.
32. All living cells require oxygen to provide energy or to build new protoplasm.
33. Every cell consists essentially of a mass of protoplasm which is usually differentiated into a central portion, the nucleus, and an outer portion, the cytoplasm.
34. Energy and matter are not created or destroyed in the reactions associated with the life processes, but are passed on from organism to organism in endless succession.
35. Throughout the life of every organism there is a building up and a tearing down of protoplasm with constant transformations of energy.
36. Infection of microorganisms is possible only under the following conditions: 1. The infecting organisms must enter the host in sufficient numbers. 2. It must enter by an appropriate avenue. 3. It must be virulent. 4. The host must be receptive.
37. Oxidation (combustion) furnishes the essential source of heat in the animal body; and other factors remaining constant, the more heat so produced the warmer the animal body.
38. Saprophytic organisms are responsible for decay by which process the necessary raw materials for growth of new organisms are released from dead matter.
39. Living things are not distributed uniformly or at random over the surface of the earth, but are found in definite zones and local regions where conditions are favorable in their survival.
40. The antitoxins produced by the body of an organism are specific.
41. The surface of the earth and the atmosphere surrounding the earth are undergoing constant changes; therefore in order to survive, organisms must migrate, hibernate, aestivate, build artificial shelters, or otherwise become adapted to these changes.
42. Certain associations of plants and animals are the result of a struggle for survival, for example, community or social life, parasitism, and symbiosis.
43. All living organisms have other living things which compete with them for the available energy.

(To be concluded)